Imperial Bureau of Plant Genetics

(For Crops other than Herbage)

Plant Breeding Abstracts

Vol. III, No. 4.

School of Agriculture

Cambridge

England

July 1st, 1933

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* General studies, see also individual crops.

Plant Breeding Abstracts.
Vol. III, No. 4.
Part I. British Empire

STATISTICS 519

551. MAHALANOBIS, P. C. 519.24
Statistical notes for agricultural workers. 3. Auxiliary tables for Fisher's *z*-test in analysis of variance. 4. Rice and potato experiments at Sriniketan, 1931.
Ind. J. Agric. Sci. 1932 : **2** : 679–93 and 694–703.
In the first of these papers the author gives three tables, modelled on Fisher's *z*-table, the first giving $\log_{10}(s_1^2/s_2^2)$, for use when natural logarithms are not available, the second giving the ratio of variance s_1^2/s_2^2 itself, and the third the square root of this quantity. The range is the same as in Fisher's table.
In the second paper the author continues his analysis by modern statistical methods of certain agricultural experiments. Those now described were carried out by the Agricultural Department of the Visvabharati.

GENETICS 575

552. NAVASHIN, M. 575.24
Origin of spontaneous mutations.
Nature 1933 : **131** : p. 436.
The effect of prolonged dormancy of seeds upon the rate of chromosomal mutations was studied in *Crepis tectorum* L. Two lots of seeds were planted in spring 1933, one having been collected in 1925 from plants which shewed a spontaneous dislocation rate of 0·1 per cent, the other from plants grown in 1926 mainly from the same 1925 seed. Over 80 per cent of the plants that survived proved to be chromosome mutants of various kinds, the plants being chimaeras of normal and mutant tissue. A control test with 1927 seeds gave similar results with 100 per cent mutation. In both experiments the abnormal conditions resembled those obtained after X-ray treatment. The author shews that the enormous increase in the mutation rate cannot have been due to selective mortality. He concludes that the main agency that caused the spontaneous chromosomal mutations should be sought inside rather than outside the cell.

553. GREGOR, J. W. 576.16
The ecotype concept in relation to the registration of crop plants.
Ann. Appl. Biol. 1933 : **20** : 205–19.
The concept of the ecotype and the various ways in which selection in a mixed population may lead to the development of specialized types are discussed. It is shewn how the process is carried still further in crop plants by the influence of artificial selection, in a direction often independent of or opposed to ecological adaptation, with the production of smaller units referred to as "agrotypes." A proposed scheme for the identification and registration of these is presented.

BOTANY 581

554. WHYTE, R. O. and HUDSON, P. S. 581.143.26.03
Vernalization or Lyssenko's method for the pre-treatment of seed.
Imperial Bureaux of Plant Genetics, Aberystwyth and Cambridge, 1933.
2*s.* 6*d.* Pp. 27.
Lyssenko and his co-workers claim that the plant is all through its life susceptible to those influences which determine its passage from one phase to another of its vegetative cycle. Thus

the influences which determine its passage to the reproductive phase can just as well be applied to a young seedling as to the older plant. This is the essence of the method, which consists in inducing the seed to start germinating and before the seed coat is ruptured to subject this " seed," which already constitutes the growing plant, to those conditions of light, temperature, etc. (according to species and variety) which it requires in order to enable it to reproduce. After this the plant will complete its reproductive cycle regardless of whether these conditions are further supplied or not.

By the aid of the method it has been possible to bring winter wheat to maturity in northern latitudes where only spring wheat can normally be grown and many other experiments of a similar nature are reported, including the treatment of potato tubers by continuous illumination before planting, after which tuber formation occurred in northern latitudes not normally suited to potato growing.

By combining these methods with ordinary breeding it is hoped to produce new races of plants which react in the ways described without the necessity of pre-treatment.

ECONOMIC PLANTS 633

555. HUDSON, P. S. 633:575:576.356.5
New methods of plant-breeding : induced polyploidy.
J. Minist. Agric. 1933 : **40** : 21–32.

Emphasis is laid on the growing importance of cytology in general in problems of practical breeding and after a popular explanation of the principles involved, examples are given of fertile hybrids between distantly related species or different genera as a result of chromosome duplication. In continuation attention is called to the possibility under modern experimental conditions of inducing chromosome duplication artificially and it is suggested that wide crossing followed by induced polyploidy may in the future become a successful and rapid method of producing new hybrids, since the hybrids so formed give constant progeny.

556. RAW, A. R. 633.1-2.4-1.521.6:575
Some aspects of plant breeding. The problem of disease resistance.
J. Dept. Agric. Vict. 1933 : **31** : 53-57.

This popular article contains a general description of the methods used and results achieved, particularly in Australia, in breeding disease resistant varieties of wheat, that are also prolific and of good baking quality. Two very promising varieties Nabawa and Ghurka, which are highly resistant to flag smut, have been found and are now widely cultivated and it seems likely that by crossing these with two other completely immune varieties, Dan and Cedar, a strain with the desired combination of qualities will be evolved. An attempt is also being made to produce varieties immune to bunt and loose smut by breeding from existing resistant forms. The problems of immunity to the rusts and foot rots is briefly mentioned ; the latter group of diseases presents special difficulties to the wheat breeder since so far no resistant varieties have been discovered.

557. NEWMAN, L. H. 633.11:575"793"(71)
The breeding of early-ripening varieties of spring wheat in Canada.
Emp. J. Exptl. Agric. 1933 : **1** : 3-16.

The origins of wheat raising in Canada are described, and interesting information on the famous Red Fife, which entered Canada probably from Galicia via Scotland, Marquis and other varieties is given. Red Fife ancestry may be found in most of the leading Canadian varieties of to-day. The breeding programme inaugurated by the Federal Government in 1888 and the work of Dr. Saunders were for many years directed towards a search for an early ripening high yielding variety of good quality, resulting in the production of Marquis, Garnet and Reward and other varieties of considerable value, though no longer grown to any extent.

Of the early importations made, the varieties most used in the breeding work were Ladoga and Onega from Russia and Hard Red Calcutta and Gehun from India. Marquis is now regarded as the standard of quality for all new varieties of Canadian wheat. Research is still in progress on high yielding, early maturing varieties and rust resistance is also being studied. Earliness has proved to be a complex genetical character.

558. McMillan, J. R. A. 633.11:575.19(94)
Varieties of wheat in Australia. A catalogue, with pedigree or source, and a genealogical chart showing the relationships of the more important varieties.
Bull. Counc. Sci. Ind. Res. Aust. 1933 : No. 72 : Pp. 28.
A catalogue that arose out of the preliminary work for a wheat breeding investigation, and represents the result of co-operation between the Division of Plant Industry, Canberra, and the State Department of Agriculture. It consists of charts and genealogical tables giving the pedigree or source of each variety of wheat grown in Australia.

633.11-2.451-1.521.6:575.11
559. Kilduff, T. 633.11:575.11
Inheritance of bunt and loose smut reaction and of certain other characters in Kota x Red Bobs and Garnet crosses.
Canad. J. Res. 1933 : **8** : 147-72.
The inheritance of reaction to bunt from Kota and bunt from Red Bobs, of resistance to loose smut (*Ustilago tritici*) and of seed colour, awns and strength of straw were studied in F_2, F_3 and part of the F_4 from Kota x Red Bobs and Kota x Garnet crosses. Kota and Red Bobs are highly susceptible to both bunts, Garnet was resistant to both but less so to Kota bunt (*T. levis*) which was much more virulent than Red Bobs bunt (mainly *T. tritici*). The bunt reaction was inherited and dominance of bunt resistance factors and also the existence of several factors governing the bunt reaction were indicated.
Kota was relatively susceptible to loose smut, Garnet resistant and Red Bobs, under the test conditions, immune. Inheritance of the reaction was indicated in F_3 but not confirmed in F_4. A genetic analysis was not possible.
There was no segregation for seed colour in Kota x Garnet crosses, but the Kota x Red Bobs crosses suggested on the whole that each variety carries a different single factor pair for red. Awn characters were probably conditioned by more than one factor pair in Kota x Garnet and by two or more factor pairs in Kota x Red Bobs hybrids. In the Kota x Garnet cross there was some indication of a two factor difference determining strength of straw, but the results for both crosses might possibly be best explained on a multiple factor basis, though this could not be tested as the classification used had not been fine enough.
Correlations shewed that in Garnet the same partially dominant factor is responsible for resistance to both types of bunt. Factors for strength of straw were apparently linked with susceptibility to bunt, and factors for awn type with bunt resistance, but it is believed that the linkage in each case involves only one of the two or more pairs conditioning the particular character linked with the bunt reaction character, and furthermore that the linkage is not strong enough to interfere with breeding for bunt resistance. A bibliography of fifty references is appended.

560. 633.13:575.127.2
Philp, J. 633.13:576.356.7
The genetics and cytology of some interspecific hybrids of *Avena*.
J. Genet. 1933 : **27** : 133–79.
Crosses were made of *A. fatua* with two forms of *A. sativa*, Banner and a form *gigantica*.
In the F_1's certain characters, e.g. non-shattering, were dominant, others, e.g. cultivated grain base, basal pubescence and awnlessness, in the upper grain were fully dominant, in the lower grain partially so.

In the F_2 and F_3 unifactorial inheritance was observed for basal articulation of grain ; study of the later generations, up to F_4, shewed that other factors also modified the expression of the character, producing gradations in the intermediate types. The action of modifiers was especially evident in the *gigantica* cross.

Plants with intermediate type of basal articulation in F_1 and succeeding generations all had intermediate basal pubescence (tuft of hairs on lateral side of base of grain), these two characters being completely correlated. Wild base plants also had pubescent rachillas, another instance of perfect correlation. Exceptional plants with cultivated or intermediate base and hairy rachillas were also observed ; this character usually segregated and was not correlated with grain base.

One exceptional plant occurred in the cross with *gigantica*, having intermediate base and hairy rachilla, and upper grain fracturing as in *A. sterilis*, which characters were inherited together in the progeny. The *sterilis* break was transmitted in reduced degree to the cultivated type progeny.

Fully awned plants were recessive and F_2 and F_3 results shewed this also to be completely linked with wild base. The expression of awns in the cultivated and intermediate type was variable, these variations being transmitted to F_3 and apparently resulting from modifiers, these being more evident in the *gigantica* cross.

Grain colour was influenced by a dominant factor B for black and a hypostatic factor G for grey, both independent of base and its linkage group type ; no Y factor such as was reported by Love and Craig was observed. B was fully linked and probably identical with pubescence of back of lower grain, although F_3 and F_4 contained certain significant deviations in the intermediate classes. In the *gigantica* cross a second independent factor also influenced these hairs ; their development moreover seems to be inhibited by the double recessive bg, since all hairy white plants proved to be heterozygous for grey. The degree of pubescence was very variable and F_3 and F_4 results suggest that modifiers may reduce the expression of the pubescence factor, especially in Banner hybrids ; colour was also influenced by modifiers, especially in the grey forms.

Hairs on the back of the upper grain were absent in the Banner F_1's but present in the *gigantica* F_1's. These hairs only developed in F_2 in plants with hairs on the lower grain, being thus also inhibited by pg.

All plants with wild base type had hairs on the upper grains and bred true, thus the hairiness factor appears to be linked or identical with the wild base factor. The modifiers reducing the hairs on the lower grain also affect those on the upper grain and it is possible that the extreme of this effect may produce exceptional wild types without hairs. Hairy plants also occurred amongst the cultivated and intermediate base type and bred practically true. These plants are explained by the existence of secondary recessive factors for hairiness. Modifiers in Banner are apparently more numerous than in *gigantica* and this probably accounts for the difference in dominance observed in the two crosses and for the fact that the ratio of hairless to hairy was different in the two crosses.

Shortness of the basal hairs was incompletely dominant to length, and determined by one factor independent of those for base type and colour.

The F_1 hybrids regularly had 21 bivalents but certain irregularities such as associations of 4, more rarely of 3, lagging univalents were observed here and in the later generations.

The present observations are discussed in relation to those of certain other investigators and the conclusion reached that the two species differ in a group of 8 characters determined by a complex of completely linked factors, just as do many of the other species studied.

This monohybrid segregation shews that one chromosone at least is common to all these species, being homologous at least along some of its length, thus making pairing possible ; the common chromosome is referred to as chromosome C. It is suggested that structural changes in the C chromosome may have occurred and be responsible for the lack of crossing-over and at the same time have favoured progressive mutation, resulting in the progressive differences between the species *A. sativa*, *A. sterilis* and *A. fatua*.

The phenomenon of " shift " is explained by constant autosyndesis, and the recurrent appearance of *nuda* plants in crosses of *A. sativa* with wild species by the occasional occurrence of allosyndesis. They appeared more frequently in some of the present crosses than in others, suggesting that the

degree of differentiation of the chromosomes may differ in different races. *Nuda* segregates have even been observed in intervarietal crosses of *A. sativa*. From the evidence presented it is argued that the base type complex and the *nuda* complex are either in different chromosomes or both in the C chromosome but more than 50 units apart. The observed chromosomal irregularities and a certain amount of sterility are quoted in support of the assumption of allosyndesis in the hybrids.
Fatuoids and the mutant with *sterilis* characters occurring in the present cross are explained on similar lines, the latter on the assumption that *A. sativa* also carries the *sterilis* complex.
The whole question of the relationship between the chromosome sets of the different species is discussed. Structural changes leading to autosyndetic pairing have been favoured by natural selection and have played a large part in the evolution of the species, together with gene mutations. The frequency of modifiers is most probably a result of the di- or tri-hybrid origin of the cultivated oats and these have played their part in the evolution of the species.

561. DERICK, R. A. 633.13:575.127.2:581.162.32
Natural crossing with wild oats, *Avena fatua*.
Sci. Agric. 1933 : **13** : 458–59.
In a plot of Banner oats plants having black or dark coloured lemmas appeared, some of which appeared to be intermediate between *A. fatua* and *A. sativa* with regard to basal articulation and awn development. On growing the dark seed segregation occurred, indicating the possibility of their being hybrids between these two species.
To test this, seeds of *A. sativa* were sown in a block, the centre of which was seeded with *A. fatua*. The seeds from each of the plants thus produced were sown the following year ; a number of dark seeds appeared, all giving plants segregating for colour of lemma, awns and basal articulation and thus confirming the occurrence of natural hybridization.
The greatest distance to which the wind carries the pollen was determined.

562. SAMPSON, K. 633.13–2.451.2:576.16
The biology of oat smuts, III. The development of two biological species of *Ustilago kolleri* (Wille) in a selection of *Avena strigosa orcadensis* (Marquand).
Ann. Appl. Biol. 1933 : **20** : 258–71.
Infections of the same oat selection *Avena strigosa orcadensis* were made with two strains of the fungus, both of which entered the host but one of which grew slowly and failed to produce infection.
It is pointed out that in studies of the inheritance of resistance the existence of differential strains of both host and fungus must be taken into consideration and that some at least of the complicated inheritance phenomena may be due to failure to allow for this.

563. RHOADES, M. M. 633.15:581.162.51:575.182
The cytoplasmic inheritance of male sterility in *Zea Mays*.
J. Genet. 1933 : **27** : 71–93.
The original male-sterile plant the progeny of which forms the subject of this investigation, arose in a planting of seeds from an open pollinated ear from Peru. The F_1 obtained when this plant was crossed by an unrelated normal plant, was completely male-sterile and without sign of female-sterility.
By crossing male-sterile plants with normal lines of the different linkage testers and crossing the F_1 of each of these crosses with the corresponding lines homozygous for the recessive genes, male-sterility was shewn to be independent of the various linkage groups.
When the F_1 of the male-sterile by normal is back-crossed, some of the families are composed of completely or partially male-sterile individuals while others are composed of male-sterile and normal plants. Silks of male-sterile plants were therefore dusted with pollen from two sources in such a way that the character of the resulting grain would indicate the male parent. The results shew no dependence of the male-sterile condition on the nature of the parent. Pollen from partially sterile plants was also used to fertilize normal plants and the results demonstrated

that no factors for male-sterility were transmitted through the pollen. Other experiments, moreover, failed to indicate any transmission of sterility through the pollen of partially sterile plants. Lastly, in the analyses testing the freedom of the chromosomes from sterility producing factors, the percentages of crossing over in lines exhibiting male-sterility was calculated and, with one exception, were found to be in fair agreement with the recorded percentages in normal lines. The general conclusion is that male-sterility is a phenomenon associated with the cytoplasm.

Since male-sterility has been traced in *Datura* to disease, various attempts were made to test whether a similar cause was effective here, with negative results. Further, no correlation was found between the sterile character and position of the grain on the ear, indicating that there are no discrete units carrying the sterile character in the kernel. Lastly, microsporogenesis was found to be normal in the male-sterile plants examined; degeneration occurred before the first vegetative division. There are certain abnormal appearances of the cytoplasmic elements of the microspores but they appear to represent merely a stage in the process of degeneration.

564. JACKSON, A. 633.16:576.16
Egyptian neolithic barley.
Nature 1933 : **131** : p. 652.

During archaeological explorations in Egypt stores of wheat and barley have been found that must have been grown between 5,000 and 6,000 B.C. by a neolithic people. One specimen contained 57 per cent of 6-rowed and 23 per cent 2-rowed barley and 20 per cent wheat. The barley was practically identical with the type in cultivation in Egypt to-day and clearly distinguishable from existing barleys in other eastern countries.

No appreciable improvement having appearently taken place during the last 7,000 years, the writer draws conclusions as to the extreme antiquity of the origin of cultivated barley.

565. MITRA, S. K. and GANGULI, P. M. 633.18(54.1)
Studies in Surma Valley rices and their classification.
Ind. J. Agric. Sci. 1932 : **2** : 571–90.

A discussion of 18 characters on which the classification is based, with remarks on certain correlations, some positive, some negative, which have been observed between certain of the characters in some of the classes studied.

566. POGGENDORFF, W. 633.18:575.12:578.08
Artificial hybridization of rice. A technique satisfactory for Yanco conditions.
Agric. Gaz. N.S.W. 1933 : **44** : 283–85.

A technique that has proved usually 100 per cent successful has been evolved. It does not necessitate mutilation of the plant during emasculation and pollination which are performed when the florets begin to open. The pollen is obtained by floating the heads on the water the temperature of which, combined with the high humidity of the air, makes the anthers swell and ripen quickly when lifted into drier air or sunlight.

567. RAMIAH, K. 633.18:576.312.35
Use of smear technique for chromosome counts in rice (*O. sativa*).
Current Sci. Mysore 1932 : **1** : 166–67.

The writer affirms the possibility of making haploid counts in rice by the smear method, in contradiction of the statement of N. S. Rao (1929).

568. RAMIAH, K., PARTHASARATHI, N. and RAMANUJAM, S.
633.18:576.356.52:576.354.4

Haploid plant in rice (*Oryza sativa*).

Current Sci. Mysore 1933 : **1** : 277–78.

It is stated that only one previous instance of haploidy in rice has been recorded. The present case occurred in one of twin seedlings from a pure line. The other twin was normal but the haploid was slightly dwarfed, exhibited complete absence of anthesis and was below normal in other respects. At sporogenesis there were 12 univalent chromosomes irregularly distributed ; various anomalies of division are mentioned.

569. BHADURI, P. N. 633.491:576.312.35

Chromosome numbers of some Solanaceous plants of Bengal.

J. Ind. Bot. Soc. 1933 : **12** : 56–64.

The chromosome numbers of some Solanaceous plants from the Calcutta area were studied in the pollen mother cells. *Solanum nigrum* L. shewed polyploidy within the species and the morphological characteristics of the various polyploid forms are given.

570. BANERJI, I. and BHADURI, P. N. 633.491:581.331.1

Polyembryony in *Solanaceae*.

Current Sci. Mysore 1933 : **1** : 310–11.

Instances of polyembryony in the *Solanaceae* under natural conditions are described. It is not rare and is generally due to the simultaneous development of more than one megaspore mother cell.

571. 633.51(81)
HARLAND, S. C. 633.51–1.525:575.127.2

Some notes on Moco cotton in Brazil.

Emp. Cott. Grow. Rev. 1933 : **10** : 100–07.

The author calls attention to Bourbon cotton, *Gossypium purpurascens* Poir, and the closely allied *G. taitense* Parl., which exists as a cultivated cotton and possesses great possibilities for breeding. A study was made of the former of these species in Brazil where it is grown under the name of Moco. Two features of this cotton are its perennial habit and extremely fine quality long lint, also vigour of growth under highly arid conditions. It is said to be one of the most valuable cottons in existence.

A brief account is given of the pests and diseases affecting the crop ; altogether it is remarkably free from diseases.

Selections of these cottons have been made by the author and one of the best had a lint length of 46 mm. At present however the crop is very impure, having been contaminated by Kidney (*G. Brasiliense*) and pure Moco can only be selected on the basis of the knowledge gained by observation of the behaviour of artificial hybrids of these two species.

In the littoral an entirely different cotton has been produced by natural hybridization between the introduced Uplands and the Moco, the bulk of the crop consists of intermediate types now thoroughly acclimatized to tropical conditions, bearing out the author's earlier contention that crossing with an indigenous form is the best way of acclimatization. The mixed hybrid cotton commands a price superior to that paid for Upland.

572. BALASUBRAHMANYAN, R. and MUDALIAR, V. RAMASWAMI.
633.51:575.127.2:581.48

A physiological study of delayed germination in cotton.

Madras Agric. J. 1933 : **21** : 147–62.

The poor and late germination in the F_2 from an interspecific cross of cotton led to this investigation of the physiological aspects of the problem. The initial material consisted of three species and two hybrids. About 4 per cent of the resulting hybrids lacked embryos, in the rest the embryo was not dormant but only reduced in vigour.

573. AFZAL, M. and SINGH, S. 633.51:575.242:677.21
A note on a floral abnormality in cotton.
Agric. and Live-st. Ind. 1932 : **2** : 634–36.

Reference is made to a plant in which the seeds were entirely free from lint or fuzz. It has bred true for four generations and appears to be a mutant.

The stigma develops much earlier than the corolla and emerges beyond it, only later being enclosed when the corolla develops. F_2 results shewed that this character is closely linked with glabrous plant body as well as the lintless character.

574. BROWN, C. H. 633.51:575.42:677.21:578.08
Purity and variability in cotton.
Emp. Cott. Grow. Rev. 1933 : **10** : 108–10.

The paper describes the application of the previously described technique ("Plant Breeding Abstracts," Vol. II, Abst. 549) to selection within the two 'apparently pure' selections of Egyptian cotton, Giza 7 and Sakha 4. By use of the 'target diagram' on the latter, it has been possible to select a family showing better lint length and higher ginning out-turn.

575. 633.51:576.353
SKOVSTED, A. 633.51:575.127.2:576.354.4
Cytological studies in cotton. I. The mitosis and the meiosis in diploid and triploid Asiatic cotton.
Ann. Bot. Oxford 1933 : **47** : 227–51.

A review of earlier cytological work on cotton is given and the discrepancies therein are attributed to difficulties inherent in the material. Consequently considerable attention is given to technique and an improved technique especially adapted to investigation in the tropics is described. The essence of this is prefixation in Winge's Picro-Carnoy followed by fixation in an osmic acid modification of Allen's Bouin.

The material studied consisted of a sterile rogue Asiatic cotton raised by J. B. Hutchinson which proved to be triploid and was derived from the three forms, *G. herbaceum* L., a strain from Turkestan, *G. arboreum* L. var. *rubicunda* Watt and a multiple recessive strain extracted from a cross between *G. arboreum* L. var. *rosea* (Watt.) and *G. arboreum* L. var. *Nanking* (Meyen). The plant in question appeared in a family resulting from the F_1 of a cross between the first two pollinated by an F_4 plant of the third.

A detailed description of meiosis and mitosis in both the diploid and triploid is given with numerous illustrations.

Owing to the unfavourable nature of the material the general discussion is limited to a comparison between the author's results and those of previous workers. The observations on somatic mitosis bear on the relationship between the nucleolus and the chromatin. The fact that with the technique adopted, gentian violet stains chromatin but scarcely stains either nucleolus or linin, while haematoxylin stains both necleolus and chromatin, indicated a slight chemical difference between chromatin and nucleolus and this fact lends support neither to the theory that the nucleolus forms the chromosomes nor to the theory that the nucleolus is formed by the excretion of substance from the chromosomes.

While there is agreement between the present and previous observations as far as the pachytene, a different interpretation is given; the pachytene strands undoubtedly represent whole paired chromosomes. A detailed discussion of the stages leading to metaphase and the forms of chiasmas exhibited leads to the conclusion that the diploid shews only 'phenotypic conjugation' while the triploid shews more of the 'genotypic conjugation.' The conclusion is drawn that Asiatic cottons are polyploids and the two species have arisen after the crossing of two different, but closely allied, 7-chromosome species with the same 6-chromosome species.

The cotton triploid is, like most of the recorded triploids, sterile but the formation of pollen grains with 39 chromosomes occurs and there exists a small chance of making a tetraploid Asiatic cotton by crossing normal diploid cottons with pollen of the triploid.

576. Norris, D. and Bates, H. T. 633.854.56(54.1)
The establishment of *Aleurites Fordii* (tung oil) in the Ranchi district of Chota Nagpur.
Indian Lac Res. Inst., Ranchi, B. and O., 1933 : Pp. 13.
General. Studies are being made on the transmissibility of the capacity to bear more than one female flower per cluster.

577. Wilson, G. F. 634:581.162.3
Contributions from the Wisley Laboratory, LXV. Pollination in orchards (VIII). Insect visitors to fruit blossom.
J. R. Hort. Soc. 1933 : 58 : 125–38.
The various species of insect visitors to fruit blossom and the pollinating habits of some of them are described. The factors affecting the number of pollinating agents in orchards are considered and the importance of having beehives situated among the trees throughout the orchard is emphasized, as many wild species of insects visit only the edges but not the centre of a plantation.

578. Thomas, P. H. 634.11 Geeveston Fanny
Apple varieties raised in Tasmania. (6) Geeveston Fanny.
Tasmanian J. Agric. 1933 : 4 : 12–14.
This is a variety similar to one produced under the same name in America. It is free from disease, vigorous and can be recommended for its colouring, flavour and shipping qualities. A pomological description is given.

579. Hofmeyr, J. D. J. 634.651:575.42
Papaw selection.
Fmg. S. Afr. 1933 : 8 : 157–58.
A popular article encouraging papaw breeders to adopt a system of continued selection for points such as the following which are being investigated at Nelspruit Horticultural Research Station :—keeping quality, shape, size and colour, eating quality, stalk length, disease resistance, yield and vigour, etc.
Various popular beliefs prevalent among breeders were investigated and the following facts have been established :—The sex ratio is 50 : 50 approximately. There is no correlation between vigour and sex. On the other hand vigorous plants tend to flower earlier and thus to fruit earlier and for a longer period and they also tend to produce fruits situated lower on the stem. Hence selection of the most vigorous seedlings (and of the most vigorous males in particular) is advised, since it seems possible that these characters may be transmitted to the progeny.
The best method of planting to ensure a suitable sex ratio of trees (ca. 1 ♂ to 10—30 ♀♀)is discussed and 4 trees per planting hole is shewn to promise the best results.
Practical hints are given on the avoidance of cross-pollination and various more general questions.

580. Sansome, F. W. 635.64:576.356.5:576.354.46
Chromatid segregation in *Solanum lycopersicum*.
J. Genet. 1933 : 27 : 105–32. [including appendix by K. Mather.]
From F_1's heterozygous for certain known factors tetraploids were produced by decapitation. The segregation ratios and linkage relationships for the diploid are given and shewn to agree with existing data by other investigators.
Factors which in the diploid are completely dominant sometimes proved incompletely so in the tetraploid when present in the simplex (e.g. R_1r_3) condition. This makes new character combinations possible, e.g. the incomplete dominance of both R and Y governing fruit colour makes possible nine distinct fruit colours, as opposed to four in the diploid.
The fertility and seed germination percentage were reduced in the tetraploids.

Observations on segregation from polyploids obtained direct from heterozygous diploids by doubling, and so duplex for various factors, indicated that chromatid pairing had occurred for the factors d (dwarf), s (compound inflorescence) and p (peach fruit) ; chromosome pairing was indicated for y (clear skin), and r (not-red flesh) was intermediate. Later generations were in general agreement, although various effects, including the deficiency of recessives, observed both in the diploids and tetraploids, made the interpretation more difficult ; moreover all the tests have not yet been completed.

The chromatids derived from the same chromosome remain together at the attachment constriction and the factors shewing chromosome segregation are evidently in this region. Similarly, paired chromosomes, when separating and dividing into chromatids, do so last of all in the region of the attachment constriction and hence crossing-over in this region is more influenced by factors determining the relative rate of chromosome movement and cell metabolism. The factors shewing intermediate behaviour are assumed to lie intermediately between the attachment constriction and the terminal regions ; the great majority of cases are of this nature. On these assumptions a method is suggested for calculating the cross-over values in autotetraploids for factors shewing chromatid segregation, and for calculating the gametic ratios ; but except in the simplest cases the cross-over percentage is nearly impossible of estimation.

581. MATHER, K. 635.64:576.356.5:581.143.5
The origin of tetraploid shoots from the callus of diploid tomatoes.
J. Genet. 1933 : **27** : 127–32.

The buds which after decapitation of the plant give rise to diploid and tetraploid shoots originate, it is stated, " in the first few layers of cells above the outer tissues of the stem." These cells are frequently binucleate. The origin of these is thought to be due to failure to form a cell wall on the part of large vacuolated cells in the callus region.

582. BOSE, R. D. 635.652
Studies in Indian pulses, No. 4. *Mung* or green gram (*Phaseolus radiatus* Linn).
Studies in Indian pulses, No. 5. *Urid* or black gram (*Phaseolus mungo* Linn. var. *Roxburghii* Prain).
Ind. J. Agric. Sci. 1932 : **2** : 607–24, 625–37.

A general description, including flowering and pollination. No cross-pollination has been observed although the author does not exclude its possibility.

The chief characters used to distinguish the types are described, followed by a key to their determination and a description of 40 types of the first and 25 of the second.

583. HADFIELD, J. W. and CALDER, R. A. 635.656:581.48:575.1
Smooth seeds arising in dimpled varieties of Marrowfat peas.
N. Z. J. Sci. Tech. 1933 : **14** : 210–19.

The paper describes a study of the occurrence of smooth seeds in Harrison's Glory and Imperial Blue, two varieties of marrowfat peas largely grown for export and having typically the dimpled shape.

The four types of seed found in Marrowfat peas are (1) Dimpled, (2) Round or oval and quite smooth, (3) Pitted, with slight pitting of the seed coat whether the seed be dimpled or smooth (4) Wrinkled. Smooth and wrinkled are due to cotyledon characters and shew a simple inheritance (3 : 1). Transmission of the dimpled character is much more involved and appears to be a seed coat character. It is recorded that wrinkled has appeared as a sport in Harrison's Glory and bred true. Pitting has not been studied but its expression is affected by seasonal variations. Between smooth and dimpled occur border-line seeds hard to classify ; they occur both in the large green dimpled (Harrison's Glory) and the smaller green dimpled (Imperial Blue).

Occasionally smooth seeds appear uniformly throughout a plant ; more commonly their appearance is partial when they occur in the upper pods or in pods on the laterals.

Of 44 plants derived from pods containing smooth seeds, 8 bore smooth seeds only, 28 dimpled seed and 8 both types. Similarly, of 49 plants from pods with dimpled seed, 7 bore smooth seed, 32 dimpled seed and 10 both types. When smooth and dimpled seed were isolated from a bulk sample and grown separately, the dimpled progeny contained 9 per cent. smooth seed and the smooth progeny 5·5 per cent. Imported seed containing no smooth seed (presumably because hand picked) and seed grown locally for four years gave in the succeeding crop 1·6 and 1·4 per cent. smooth seed respectively. Grown on netting 5 ft. apart and seeds 1 ft. apart in the row and, for comparison, in rows 1 ft. 6 in. apart and seeds 6 in. apart in the row, the former gave from smooth seed 5 per cent. smooth and from dimpled, 0·6 per cent. smooth while the latter gave from smooth seed 6 per cent. smooth and from dimpled, 18 per cent. smooth. Lastly, from selected pods seed was divided and sown under two very different climatic conditions. Seven cases shewed general similarity and six dissimilarity.

It is concluded that the current opinion relative to degeneration of locally grown stock is erroneous and that seasonal variation plays an important role. In 1930-31 over 30 per cent. of the crop was smooth seed ; in the past season between 7 and 8 per cent.

The difference between the two types lies in the starch grains, those of the dimpled varieties having a larger proportion of slits and it is possible to differentiate between the two with a reasonable degree of accuracy. Dimpled seed contains a slightly higher protein content and it is suggested that the smooth seed has not reached full maturity.

584 MERKENSCHLAGER, F. 575:63.00.15(47)
Das russische landwirtschaftlich-botanische Forschungsnetz. (**The Russian net of experiment stations in agricultural botany.**)
Züchter 1933 : **5** : 44-46.

Two maps are given shewing the distribution of existing and future experimental stations for agricultural botany in European and Asiatic parts of the U.S.S.R. All such stations are primarily breeding stations and all other branches of botany are subordinate to plant breeding. The centres are situated in widely differing geographic and climatic zones in which the breeding of various groups of crops is studied.

585. WRIGHT, S. 575.114:519.24
Inbreeding and homozygosis.
Proc. Nat. Acad. Sci. Wash. 1933 : **19** : 411-20.

The rate at which heterozygosis diminishes in populations not subject to any selective influences has been calculated by the method of path coefficients, for various types of segregation and the present contribution extends the method to the case of sex-linked genes. The use of the method is explained and examples given of its application to various types of segregating populations.

586. WRIGHT, S. 575.114:575.116.1:519.24
Inbreeding and recombination.
Proc. Nat. Acad. Sci. Wash. 1933 : **19** : 420-33.

The correlations between two characters in populations resulting from different kinds of mating were worked out by the method of path coefficients. In a number of cases the results were identical with those calculated by Haldane and Waddington, in some cases different results were obtained.
The conclusions reached are that in freely interbreeding populations of long standing combination is nearly random even if linkage is present, unless the populations are small or linkage very close.

587. POOLE, C. F. 575.129:576.356.5
Constant species hybrids.
Amer. Nat. 1933 : **67** : 188-90.

Various amphidiploid hybrids which preceded *Primula kewensis* both in discovery and cytological explanation are mentioned.
It is further pointed out that such hybrids are constant only when there is no interspecific chromosome pairing and that when such pairing occurs irregular gametogenesis and segregation occur.

588. COHEN-KYSPER, A 575.172
Die Bedeutung des Gens für Determination und Entwicklung. (**The significance of the gene in determination and development.**)
Naturwissenschaften 1933 : **21** : 229-35.

In analysing the nature of the gene it is pointed out that the gene which we say " determines " any particular character in reality is only one member of a complex of determinants ; any particular gene swings the chain of reactions over in the direction which results in the character in question. These in turn are part of a larger complex, the chromosome system, which only when the necessary conditions are present lead to the development of a particular character or group of characters. The gene is thus only in so far permanent that the chromosomes are identical from one generation of sex cells to the other.
Crossing between two forms is only possible when the complexes of both are in a large measure identical ; from this it results that those factors in which they do differ bring about identical reactions in the other complex when crossing-over occurs ; and also that crossing-over in the more fundamental characters does not occur.

589. STEIN, E. 575.255:537.531
Ueber vegetativ durch Radiumbestrahlung entstandene Periklinal-Chimären von *Antirrhinum.* **(Periclinal chimaeras of Antirrhinum arising vegetatively by treatment with X-rays.)**
Z. indukt. Abstamm.-u. VererbLehre. 1933 : **64** : 77-94.

By irradiation of developing embryos certain plants among others were obtained, in which the dermatogen had mutated with the consequent production of periclinal chimaeras. Some of these are here described. Smaller leaves than the normal is a common characteristic. Certain other plants are described in which the mutation had occurred in the subepidermal layer. Many of these were colour and form mutants.
Many of the plants were sterile but when flowers were produced the mutant characters were not inherited. No chromosome alterations were detectable and the changes are ascribed to point mutations.
The chimaeras produce side shoots of entirely normal character.

CYTOLOGY 576.3

590. BELLING, J. 576.312
Critical notes on C. D. Darlington's " Recent Advances in Cytology."
[(A posthumous paper) with reply by C. D. Darlington.]
Univ. Calif. Pub. Bot. 1933 : **17** : 75-110.

A detailed criticism of a number of statements in Darlington's recent book (see " Plant Breeding Abstracts " Vol. III, p. 39) in which the reviewer takes exception to Darlington's free use of speculation, or rather to the failure to indicate in the text that particular views are conjectures and not facts. The terminology is also criticized and certain mis-statements and other inaccuracies pointed out.
In his reply Dr. Darlington accepts many of the criticisms whilst defending the speculative point of view.

591. BRIEGER, F. 576.354.4:575.114
Die genaue Bestimmung des Zeitpunktes der Mendelspaltung. (Sammelreferat.) **[The exact determination of the stage at which Mendelian segregation occurs. (Survey of literature.)]**
Züchter 1933 : **5** : 34-44.

It has been possible to demonstrate by diverse techniques that segregation may occur in some organisms at the first maturation division, in other organisms at the second division, and in still other organisms at either division. Moreover segregation often depends to a considerable extent on external and internal factors. The author suggests that, apart from the great theoretical importance of these facts, they may possibly have a practical bearing on the problem of mutation or the artificial production of unreduced polyploid germ cells.

BOTANY 581

592. BÜNNING, E. 581.143.26 :575
Die Erblichkeit der Tagesperiodizität bei Pflanzen. **(The inheritance of daily periodicity in plants.)**
Naturwissenschaften 1932 : **20** : 340-45.

The rhythmic day and night rise and fall of *Phaseolus multiflorus* is capable of artificial control by altering the alternation of light and dark, or under constant illumination by altering the alternation of heat and cold. Under various conditions however such movements have been observed quite independently of any possible external stimulus, which autonomous movements are, moreover, more rapid at high than at low temperatures. These autonomous movements have been proved independent of the previous influences to which the seed was exposed on the parent plant and are thus conditioned hereditarily. The fact that they coincide with the movements induced by the normal alternation of night and day may be a selection effect, which can only be proved by studying whether such movements influence the survival value of the plant.
The author considers that other periodicities, e.g. annual, will eventually be subjected to similar analysis and explanation.

593. NERLING, O. 581.143.26.03
Die Jarowisation des Getreides nach T. D. Lyssenko. (Lyssenko's method of vernalization of cereals.)
Züchter 1933 : **5** : 61-67.
A brief account in German of some of the results referred to in Abstract 554 above.

594. RYERSON, K. A. 581.9
Plant explorers bring valuable new species and varieties to U. S.
Yearb. U. S. Dept. Agric. 1932 : 297-302.
Expeditions to different parts of the world have enabled American explorers to collect innumerable specimens of interest to the breeder ; amongst these are about 3,000 varieties of soya bean, 200 different oriental persimmons, 90 cultivated varieties of chestnut (amongst which it is hoped to find blight-resistant individuals), large collections of Turkestan and Spanish lucerne for resistance to bacterial blight, of melons, pistachio and wild fruits from Turkestan and Persia, promising strains of wheat and barley from Russia, some of which are expected to be disease resisting, and grapes and apricots from north Africa. Expeditions have also been made covering the islands of the Mediterranean and to Latin America for *Solamum* species, also the new fibre tree *Ceiba acuminata*, wild cottons and relatives of maize, hardy avocados and many others have been introduced.

595. WOODWARD, C. H. 581.9
Dr. Vavilov pleads for concerted work in studying plant origins.
J. N.Y. Bot. Gdn. 1933 : **34** : 108-11.
A very brief résumé of Vavilov's studies of plant distribution, passing reference being made to the new Abysinnian species of wheat, of which one is immune to all wheat diseases, resistant potato species from South America capable of developing tubers in Europe, etc.
An appeal is made to the botanists of the world to co-operate in such studies.

596. ALLYN, R. S. 608.3:633
Plant patent queries. A patent attorney's views on the law.
J. Hered. 1933 : **24** : 55-58.
The views of a legal expert in patent law.

597. COOK, R. C. 608.3:633
More plant patents.
J. Hered. 1933 : **24** : 49-54.
A discussion from the breeder's standpoint of the 1930 statute governing plant patents in U.S.A.

AGRICULTURE 63

598. 63.00.15(47)
(The agricultural science, serving the Soviet Abhkazia. Interview of the Academician N. Vavilov, President of the Agricultural Sciences' Academy of the name of Lenin, with the representative of the newspaper "Soviet Abkhazia.")
Subtropics 1932 : 4th year ed. No. 2 (12) : 3-8.
Starting with brief remarks on the recent achievements in agricultural reconstruction, the work of the research stations is then mentioned. Already over 640 species and sorts of subfruits and 600 of various new food plants have been collected. Of eucalyptus alone 120 species and varieties, also 800 ethereal oil plants, 1,000 forest plants from all over the world and large quantities of ornamental plants. Great hopes are entertained of a *Solidago* species for rubber production. A special breeding station for dealing with these plants has been created.
Breeding cold resistant citrus is one of the primary aims of the work.

599. DEREVITZKY, N. F. 631.421:519.24
(The investigation of the accuracy of comparing means in the experiment with a scattered situation of replications.)
Bull. Appl. Bot. Leningrad 1932 : Ser. 2 (3) : 137-87.
The paper describes the methods of statistical analysis suited to the working out of trials consisting of a number of varieties arranged with replication in long narrow strips. The method is that familiar under the name " randomized blocks ", except that the varieties are not randomized. The author goes on to shew that variation within the block due to a soil gradient may in many cases be allowed for by a modification of the analysis, in which regression coefficients are calculated for each block, and the deviation of the actual from the calculated yield is used to furnish a basis for experimental error. The mathematics of the least square solution is described.

600. SESSOUS, G. 631.421:633:575
Mängel der Sortenprüfung, eine Betrachtung zur Verfeinerung züchterischer Arbeit. **(Lack of variety tests, a note on the refinement of breeding work.)**
Z. Züchtung 1933 : A. 18 : 163-67.
Experiments are described in which the best variety of a group came lowest on the list when the comparative tests were carried out under unfavourable conditions and the necessity is stressed of testing a new variety under various conditions of spacing, manuring, time of sowing, etc., before drawing any conclusions as to its merits.

PLANT DISEASES 632

601. GREANEY, F. J. and MACHACEK, J. E. 632.484:575.243
The production of a white fertile saltant of *Helminthosporium sativum* by means of ultra-violet radiation.
Phytopathology 1933 : **23** : 379-83.
In studying the effect of ultra-violet light on the rate of growth and of saltation in *Helminthosporium sativum* Pammel, King and Bakke, several monosporous strains were used. Growth and saltation in some strains were affected by shorter exposures than in others.
The general effects in susceptible strains were marked inhibition of growth, increased pigmentation and saltation rate. The saltants tested remained true to type. Both sterile and actively sporulating strains were obtained, the formation of the former type being closely correlated with loss of pigmentation. An albinistic strain permanently established, is described. No difference could be detected in the relative pathogenicity of the saltant and its present form. The taxonomic importance of this new type and the potential difficulties to which its occurrence in nature would give rise are pointed out.

ECONOMIC PLANTS 633

602. BROEKEMA, C. 633 :575
Internationale Zusammenarbeit auf dem Gebiete der Pflanzenzüchtung. **International co-operation in the field of plant breeding.)**
Z. Züchtung 1933 : A. 18 : 147-52.
The author points out the enormous advantages which would accrue to all countries by internationally organized expeditions to the gene centres followed by distribution of the suitable material to the appropriate countries ; by international agreement on the patent law ; by internationally organized variety testing to prevent the lag of often 10—25 years between the creation of a useful variety and its penetration to all countries where it may be urgently needed.
He goes on to point out the failure of the International Association of Plant Breeders and favours the idea that it should be reorganized on the basis of centralized representation by countries rather than personal membership.

603. BAUR, E. 633:575(43)
Was kann die Pflanzenzüchtung tun, um die Inlandsübererzeugung in den wichtigsten landwirtschaftlichen Erzeugnissen zu verhüten. (**What can plant breeding do to prevent the internal over-production of the most important agricultural commodities**?)
Mitt. deuts. LandwGes. 1933 : **48** : 173-74.

In the question of home production of proteins the Müncheberg institute has assisted firstly by the development of " sweet " blue lupins, of which 10-15,000 double centners of seed will be available at moderate prices for sowing in the 1933/34 winter. In the ripe state both seeds and straw will be used as fodder and the fresh plant as green fodder. It is expected that they will replace oil cake almost entirely. The young seeds can be used also as a fresh vegetable.
From potato crosses already in an advanced stage involving South American wild forms it is confidently expected that races resistant to all physiological forms of phytophthora and to cold will be produced.
Attempts are being made to breed suitable oil plants for home production.

604. WACKER, J. 633:575(43)
Die württembergische Landespflanzenzüchtung. (**Plant breeding in Wurttemberg.**)
Z. Züchtung 1933 : A. **18** : 153-62.

A brief historical sketch is given, with an indication of the most outstanding varieties produced in the Hochschule Hohenheim and the various seed firms of the district. The objects are to create varieties suited to every part of the district and it is thought that this has been attained with regard to wheat, barley, field beans and peas, oats and flax. In order to attain this each firm occupies itself with the particular crops most grown in the surrounding country. The personnel of all these various firms and stations have formed a central association, the " Vereinigung württembergischer Pflanzenzüchter " for the exchange of experience and ideas and for the standardization of methods, etc.

605. ROEMER, T. 633:575:575.113.42
Transgressionszüchtung. (**Breeding by use of transgressive segregation.**)
Z. Züchtung 1933 : A. **18** : 168-78.

The author shews how the next stage after the combination of different characters by hybridization is the combination of the different factors determining one and the same character in an exactly similar way, thus making use of the transgressive segregates. Examples are given in crosses of peas of transgression in respect of seed size and time of flowering, of time of earing in barley and oats, of strength of straw in oats and wheat.
In spring barleys certain segregates from Rimpaus Hanna x Pfauengerste eared as much as 10 days earlier than the early parent, also forms so early as to be capable of giving a crop after early potatoes or being cultivated at altitudes of 600—700 m appeared. Similarly in crosses of Kaura Nopsae oats, so far the stiffest strawed of any known form, segregates much stiffer still have appeared.
As the breeder becomes familiar with the behaviour of the different lines he ought to be able to make crosses with the definite object of producing transgressive segregates for a particular character.

606. *KOMAROV, V. L. 633 :576.16
(**Origin of cultivated plants.**)
State Press of Agricultural and Co-operative Literature, Moscow-Leningrad 1931 : Pp. 240

A review of the views of various investigators, starting with Darwin, de Candolle and the early geneticists and finally those of the present Russian school. The views prevailing up to 1930 on the origin of individual plants are outlined in the case of the chief sugar, cereal, root, stimulant, oil and fibre plants, and various fruits and vegetables are also included.

* An abridged translation of this work is on file at the Bureau.

607. GOESTER, L. E. 633:576.16
De herkomst en het ontstaan der cultuurplanten. (**The origin of crop plants.**)
Pharm. Weekbl. 1932 : 69 : 1105–24.

The views of Vavilov on the origin of the major crops, whose cultivation dates from prehistoric times and whose ancestors are lost, are illustrated by reference to wheat.

The various points of difference between cultivated and wild plants are enumerated and discussed. These are mostly useful to man, but useless or directly prejudicial to the perpetuation of the plant. Such characters appear also in weeds of cultivated plants, some of which have gradually become converted into independent cultivated plants. The origin in this way of the secondary crops is illustrated by rye, in which case in the lowlands of its centre of diversity the whole range of variation is found among weed forms in wheat fields ; in the highlands and neighbouring countries with unfavourable conditions the wheat has fallen out and pure rye fields result. Another mode of origin of cultivated forms is the gradual taking into cultivation of weed forms growing in the vicinity of man's dwellings ; hemp is given as an example.

The occurrence of these processes in a limited number of mountainous regions is ascribed to the greater variability of conditions and thus of the plants in these regions, giving the necessary diversity of forms to enable man to use them as food supply. Other reasons are also mentioned for regarding the highlands as the earliest dwelling places of man and a certain amount of evidence is given to shew that the colonization of Europe was effected by races coming from those regions which are regarded by Vavilov as the centres of distribution of our cultivated plants.

608. VAVILOV, N. J. 633:576.16
Der jetzige Zustand des Problems der Entstehung der Kulturpflanzen. (**The present position of the problem of the origin of cultivated plants.**)
Biol. Generalis, Vienna 1932 : 8 : 351–68.

The modern student investigates the problem of origins not only historically but dynamically, seeks, that is, to know the processes of origin so intimately as to be himself in a position to create new forms.

To achieve this the first necessity is to know the geographical distribution of the innumerable elements composing a given species, together with the point at which these elements occur in greatest abundance. This not infrequently fails to coincide with the area of the related wild species, of which numerous examples are furnished. These centres of diversity are regarded as the original centres of origin of a given species, from which the genes have gradually spread. Seven main world centres are recognized, in South West Asia, in India and the adjacent eastern region, in the mountains of western China, in Abyssinia, in the Mediterranean region, in South Mexico and the adjacent countries to the south, and in Peru.

The most recent studies have shewn that the processes of origination have taken place in extremely limited areas, especially so as regards the western Asia centre, where in an area of a few hundred kilometres the entire diversity of soft wheat, pulses, flax, carrots, etc. is contained. All these crops in this region are characterized by a series of primitive characters. Similarly within the Central and South American centres small loci occur, certain groups of plants being strictly confined to one or other of these loci. Again the small Abyssinian region contains over 220 endemic varieties, each comprised of innumerable forms, of wheat and barley and the same holds for certain oat species in the Pyrenees and fruit trees in the Caucasus. The determination of these loci is of particular importance in the study of form origination—for instance 12-13 cultivated species of potato, as opposed to the one previously known, have been discovered.

In addition to the obvious morphological differences, clear physiological differences are observed in this material and genetic experiments, which have only just begun, have already shewn that behind the apparent uniformity of the forms at the centres an enormous variety of genes is hidden, e.g. the Abyssinian pea contains all the main genes of all peas cultivated in Europe. Elaborate genetic work is necessary to separate out the desirable genes, except in certain cases, as with certain Abyssinian barleys which have been directly introduced into cultivation in the U.S.S.R. with success.

Many of the main crop plants have very sharply localized genes ; certain ones have discrete areas (cotton) and rarely the primary area of form origination is rather extensive as in *Beta*, or scattered over a whole continent as in the water melon.
Dominance is the characteristic of the centres, the proportion of recessives increasing towards the periphery. Some of these recessive forms are of particular practical importance.
The merging of one species into the other, as in the 28 chromosome wheats of Abyssinia which morphologically are hardly to be distinguished from *vulgare* wheats and numerous other examples, is an instance of specific differentiation actually taking place.
Certain areas display a concentration of a number of loci for a number of different plants, e.g. the foot of the Himalayas, South Mexico and Guatemala.
These facts will greatly alter the views on the origin of agriculture, which must now be regarded as having occurred at a number of different times and in different places independently. Recent discoveries on constant fertile species and genus hybrids have removed the gulf between the Linnean species and the genus and this, together with mutations, has shed great light on the problem of the origin of organisms.

609. BUCHINGER, A. 633:576.341
Die Keimprüfung in Zuckerlösung (" Saugkraftbestimmung ") und ihre Bedeutung für die Sortenkunde. (Ein kritischer Ueberblick.) Einige Bemerkungen zu diesem Aufsatz von Eduard Schratz. **[Germination tests in sugar solutions (" osmotic pressure determination ") and its significance in the study of varieties. (A critical survey.) Some remarks on this paper by Eduard Scratz.]**
Züchter 1933 : **5** : 88-94.
A detailed reply (supported by numerous quotations) to Schratz's criticism of Buchinger's interpretation of the terminology of osmotic phenomena and also his technique.

610. SCHRATZ, E. 633:576.341
Entgegnung auf vorstehende " Bemerkungen von A. Buchinger ". (**Reply to previous " Remarks by A. Buchinger ".**)
Züchter 1933 : **5** : 94-95.
A counter-criticism of Buchinger's reply (see above).

611. SNELL, K. 633:608.3
Sortenschutz in Deutschland und in anderen Ländern. (**Protection of varieties in Germany and other countries.**)
Züchter 1933 : **5** : 68-72.
An account of the laws and regulations for guaranteeing authenticity and protection to the products of the breeder in Germany, England, Holland, America, France and various other countries.
The majority of countries are striving to get some sort of government control if this is not already in existence.

CEREALS 633.1

612. NICOLAS, G. and CHALAUD, G. 633.1:575(44)
Le centre de sélection et de génétique de l'Institut agricole de l'Université de Toulouse. Essais et résultats de 1932. (**The centre for selection and genetics of the Institut agricole de l'Université de Toulouse. Trials and results of 1932.**)
Prog. Agric. Vitic. 1933 : **99** : 151-55.
A report on wheat variety tests carried out by the Genetics Department of the Agricultural Institute, Toulouse. The results from 150 pedigree lines of hybrids of various generations are described.

613. ZADE, A. 633.1:581.142
Experimentelle Untersuchungen über die Auswuchsneigung als Sorteneigenschaft des Getreides. (**Experimental investigations on the tendency to sprouting as a varietal character in cereals.**)
Z. Züchtung 1933 : A. **18** : 212-22.

From plants which had grown in identical conditions carefully controlled, an ear was taken, all ears being of the same degree of maturity. The ears were moistened and hung up in a moist room together with a standard variety. Of each variety 200 plants were treated in this way.
Extreme differences in the tendency to sprouting were observed in the different varieties of summer and winter barley and winter wheat.
Moreover, some varieties became capable of sprouting very rapidly after harvest, others only gradually and after a certain lapse of time that differed according to variety.
In oats and rye on the other hand varietal differences were only slight, all varieties shewing an equally great tendency to sprouting.
The necessity for repeating the tests in a number of successive years is emphasized.

WHEAT 633.11

614. TALANOV, V. V. (Editor) 633.11
(**The sorts of grain crops and the regions of their distribution. I. Spring and winter wheat.**)
Lenin Acad. Agric. Sci., Inst. Pl. Ind., Division Var. Tests, Leningrad 1932 : Pp. 491.

In the introductory section the editor outlines the schemes whereby the task of raising the quality of the cereal crops is being achieved. To replace the present impure material by pure seed of sorts characterized by greater yield and quality, to extend the range of cultivation by the introduction of frost, disease and drought resistant or earlier maturing sorts, of a type which under conditions of mechanized farming do not shed or lodge and develop their fruit well away from the ground—these are the major problems with which the breeder and agronomist are confronted.
The present work is devoted to a study of the various selected sorts available and their suitability to the different regions, combined with an attempt to standardize the sorts by furnishing accurate descriptions of them, the final object being to make recommendations as to the sorts most suited for cultivation in the respective places.
The main characteristics of the various regions are outlined and the behaviour of the different lines is discussed. Certain lines proved to be highly recommendable for the whole Soviet Union, others for certain definite regions. These lines are illustrated and described, both from a botanical and agronomic point of view, their origin also being indicated. Special chapters are devoted to resistance to shedding, rust and bunt, and charts are supplied with the volume to illustrate the zones in which the cultivation of the different lines is (1) obligatory, (2) desirable and (3) permissible.

615. SCHRIBAUX 633.11(44)
Les nouveaux blés de mars expérimentés à la Station Centrale de Sélection de Versailles. (**The new varieties of spring wheat tested at the Versailles Central Experimental Station for Plant Breeding**).
C.R. Acad. Agric. Fr. 1933 : **19** : 344-51.

Among the 5 early and 5 late varieties tested in 6 replications, the best yields were obtained with the hybrid varieties Florence Aurore and Moyencourt 31, and Heine's Kolben ; the best baking value was found in Bankut, Florence Aurore, Extra Kolben II and Szekacz. Other hybrids which may eventually replace Florence on account of their earliness and resistance to adverse climatic conditions are being tested.

616. SCHRIBAUX, and BOEUF, F. 633.11:575(61.1)
À propos du blé Florence x Aurore utilisé comme blé de printemps en France et des blés Pusa x Florence. (**On Florence x Aurore wheat used as a spring wheat in France and on wheats from the Pusa x Florence cross.**)
C.R. Acad. Agric. Fr. 1933 : 19 : 488-96.

Two reports describing the stages in the work of selection being carried out with the two wheat crosses Florence x Aurore and Florence x Pusa, in an attempt to breed wheats specially suited to North African conditions.

Individual plant selection has been practised since the third generation and pure lines have now been isolated from Pusa x Florence, and it is hoped that this will be possible this year for Florence x Aurore too. Successful yields have been obtained with Florence x Aurore and especially Florence x Aurore 588. Unfortunately Florence x Aurore is susceptible to yellow rust. The Pusa x Florence strains are not quite equal to Florence x Aurore, but have the same qualities as Florence x Aurore 588 and are somewhat less susceptible to yellow rust. Both varieties proved to be high quality wheats, and though very early yet gave good yields and they may be used either for spring or autumn sowing.

617. RAUM, H. 633.11:575.061.2:581.46
Ueber Spindelgliedlänge und Dickkopfform des Weizens. (**Length of rachis segments and squarehead form in wheat.**)
Z. Züchtung 1933 : A. 18 : 179-90.

Only those descendants or hybrids of the original Squarehead which still retain the Q factor complex and for which the ratio of the rachis length in the upper part of the ear to that in the lower is thus less than 0·83, are counted as squarehead. To these are added certain medium dense squarehead types whose origin is unrelated to the original Squarehead.

Another group in which the segments are shorter than the upper is fairly common.

The genetic formulae for types with various segment lengths from hypercompact to superlax are given and the classes into which the various squarehead forms fit are discussed. The Q factor is absent in the 14 and 28 chromosome groups.

618. CRESCINI, F. 633.11:575.1"793"
"Precocità" e "primaverilità" in F_2 da incroci di *T. vulgare* (Vill.) [**Earliness and the "vernal character" in the F_2 of crosses of *T. vulgare* (Vill.)**]
Ann. Tecn. Agri. Rome 1933 : 6 : 36-56.

Previous work, including that of the author, is quoted to shew that both light and temperature exercise an influence, within certain limits, on the earing of winter wheat when sown in spring and that the character "earliness" is capable of manifestation in the absence of the "spring" character.

Crosses were made between races whose behaviour under conditions of spring and autumn sowing was known. In March 1930 the parents and the F_2's were sown side by side and the dates of earing are given in the form of frequency distributions and graphs.

Line 193, early spring wheat was crossed with line 31, less early and not spring, with line 95, late, not spring, and with 87, late like 95 but spring. From the results the author deduces that the factor "earliness", more pronounced in 31 than in 95, is incapable of expressing itself when associated with the character winterness, but it is again manifested when associated with springness, as seen in the progeny of 193 x 31, the spring sections of which are earlier than those of 193 x 95.

The F_2 of 193 x 31 gives a trimodal segregation curve, that of 193 x 95 a monomodal. The former contained 87·4 per cent. of spring and 12·6 per cent. of winter, calculated from a total of 214 plants, the latter 70·9 per cent. spring and 29·1 per cent. winter calculated from 285 plants.

The F_2 of 193 x 87 was intermediate between the two parents, in the form of an almost normal frequency distribution.

In the cross 31 × 87 certain segregates were earlier than 87 and 23 plants out of 104 failed to ear.

The spring : winter ratios in the cross 193 x 31 in 1931 were 197 : 53, and similar in the cross 95 x 87 which parents differed in winterness but not in earliness.
The results demonstrate the power of the spring factor to mask the expression of certain other factors, e.g., earliness, and that these two are inherited independently and can be combined from different parents.

619. TINGEY, D. C. 633.11:575.11-181.13
Inheritance of dwarfing in wheat.
J. Agric. Res. 1933 : **46** : 75-94.
Genetic data on dwarfing in wheat (due to shortening of lower, second or third internode or both) were obtained from a detailed study of 15 crosses and were supported by more general observations on 77 other crosses involving over 50 strains and varieties. From the results in the F_2 and F_3 generations it is suggested that dwarfing depends on a dominant dwarfing factor DD in combination with the recessive condition of an inhibitor II which is found in the dominant condition in the tall plants. Dwarfs are therefore DDii and tall plants are either DDII, ddii, or ddII, the last named being a type discovered in the course of some intervarietal crosses. Dominance of DD was found to be incomplete in F_2.
Natural crossing was demonstrated between tall and dwarf plants. A biometric study of height in tall and dwarf plants shewed greater variation of the latter type. A tentative genetic classification of the wheat strains and varieties used is attempted on the basis of their behaviour as regards the dwarfing (or tall) character.

620. DUSSEAU. 633.11:575.127.2:632
Sur le comportement de *Triticum haplodurum* et des formes issues du même croisement vis-a-vis des différentes maladies du blé manifestées en 1932. (**The behaviour of *T. haplodurum* and forms originating from the same cross towards the different diseases of wheat occurring in 1932.**)
Rev. Path. Veg. 1932 : **19** (8-9-10) : 236-37.
Fungi of the most diverse kinds, including even *Cladosporium* and ergot, were observed on the *haplodurum* referred to in a previous article (" Plant Breeding Abstracts " Vol. III, Abst. 54). It was resistant to *Puccinia glumarum* and apparently also to smuts.

621. MATSUMOTO, K. 633.11:575.127.5:576.356.1
Zur Kritik der Kryptogonomerie-Theorie von Bleier. (**A critique of Bleier's cryptogonomery theory.**)
Mem. Coll. Agric. Kyoto Imp. Univ. 1933 : No. 25 : (Genet. Ser. No. 1) : 1-10.
An examination of the pollen mother cells in existing cytological material of various hybrids and original investigations with *Aegilops ventricosa* x *Triticum durum* failed to disclose the occurrence of cryptogonomery described by Bleier in wheat x rye and *Aegilops* x wheat crosses. This phenomenon consists in the parent nuclei in hybrids retaining their individuality until the reduction division and separating at reduction. The author's orthodox interpretation of Bleier's results is based on a comparative analysis of his own and Bleier's plates. While holding that in Bleier's material invariably only one spindle was present and not two, as claimed, the author adds that theoretically Bleier's contention is possible, but proof is still lacking.

622. LAUMONT, P. 633.11:575.127.5:633.11 *Aegilops*
Contribution à l'étude des hybrides de blé et d'égylope. (**Contribution to the study of wheat and *Aegilops* hybrids.**)
Bull. Soc. Hist. Nat. Afr. 1932 : **23** : 123-26.
After a short survey of previous work on wheat-*Aegilops* hybrids the author describes crosses between *A. triuncialis* L. x *T. durum* Desf., *A. Speltoides* Tausch x *T. durum* Desf., *A. Aucheri* Boiss. x *T. durum* Desf. One grain resulted from the first cross and the remaining crosses gave no progeny.
The F_1 obtained was intermediate in morphological characters and was of low fertility. The 37 F_2 shewed no resemblance to the parental plants, 2 were speltoid, 1 resembled the F_1 and 34 others were of intermediate type. Similar variations and low fertility occurred in F_3 with additional forms resembling the *vulgare* wheat type.

623. OEHLER, E. 633.11:575.127.5:633.11*Aegilops*

Untersuchungen über Ansatzverhältnisse, Morphologie und Fertilität bei *Aegilops-Weizenbastarden.* I. Die F_1–Generation. (**Investigations on the set of seed, morphology and fertility in *Aegilops*-wheat hybrids. I. The F_1 generation.**)

Z. indukt. Abstamm.-u. VererbLehre. 1933 : **64** : 95-153.

Observations were made on the F_1 hybrids, extensive material of which was obtained by autumn sowing followed by vegetative propagation in the spring.

Aegilops was all through used only as female parent. Four to five races of each of the 18 *Aegilops* species were crossed with *Triticum aegilopoides, T. monococcum, dicoccoides, dicoccum, durum, turgidum, polonicum, Spelta, vulgare* and *compactum,* and also *T. villosum* and *Secale cereale.* The degree of success is tabulated.

Many of the crosses are here described for the first time, e.g., *Ae. comosa* x *T. turgidum, Ae. uniaristata* x *T. vulgare, Ae. columnaris* x *T. Spelta* and *T. vulgare.*

Differences were observed in the behaviour of the different races of the same species but these were inconsiderable.

The best results were obtained with *Ae. cylindrica* and all members of the section *Pleionothera,* with a percentage set of 10-30, except in the 14 chromosome races of *Ae. triaristata* and *Ae. umbellulata* where 5.46 and 7.90 per cent respectively were obtained ; the worst with *Ae. speltoides, Ae. ligustica* and the section *Platystachys,* which systematically stands closest to wheat. It is pointed out moreover that *Ae. cylindrica* and *Ae. ovata,* the species which have possibly contributed to the wheat parentage, come in the least successful group.

All 7 chromosome species, of each genus, gave low set but this seems in part at least to be a result of their late flowering, which altogether seems to be the factor most influencing success.

The germination of the grain was of the same order as the set.

The F_1 plants are described and compared with the parental forms. There was dominance of the *Aegilops* habit of growth, solidity of straw when present, hairiness of nodes, presence of long hairs intermixed as in *Aegilops,* with short ones, on the leaf sheath, colour of auricles, *Aegilops* type of the latter, hard and tight glumes of *Aegilops,* number of florets per spikelet and formation of long ear in terminal spikelet as in *Aegilops.*

The F_1's were intermediate in respect of tillering, which varied however in the different crosses, and of length and thickness of culm, form, colour and pubescence of leaves, pubescence of rachis margins as in wheat, wheat keel and strongly developed *Aegilops* nerves, form of ear and glumes.

The hybrids from the individual crosses are described with respect to character of ear (shattering), length and density, number of spikelets, character of glumes and awns.

Certain ear forms, such as that of *T. monococcum* and *Ae. triaristata* were more or less dominant, and the density of *T. durum* and the laxity of *T. Spelta* was always detectable in the hybrids.

Although the length of rachis was mostly intermediate there were some cases where the hybrids were as long as or longer than the *Aegilops* parent in density, as also sometimes in number of spikelets, which however is usually intermediate.

The shedding of the whole ear (*Aegilops*) is dominant ; the shattering characteristic of *Ae. cylindrica* and *Ae. ventricosa* is intermediate, of *Ae. triuncialis, Ae. columnaris,* and *T. Spelta* dominant.

The hybrids of *Ae. umbellulata* x *T. monococcum* were intermediate, those of *T. dicoccum* perfectly tough.

The broad tooth furthest from the rachis in *Ae. ventricosa* and *Ae. cylindrica* or the species of the section *Macrocathera* is dominant but the near tooth of these species and all the teeth of species of *Pleionothera* are influenced by the inhibiting factors in the wheat parents and only develop awns when inhibitors are absent, i.e., when the paleae of the wheat parent are awned. The length of the awns when developed is also influenced by the factors present in the wheat parent. The awning of the paleae is exactly similar. In all cases the number of teeth or awns is the same as in the *Aegilops* parent.

Selfing and even crossing with sister plants gave no seed at all. Backcrossing with various wheat species gave an average success of 0·32 per cent, with *Aegilops* 0·42 per cent. Success varying between 0·2 and 11·30 per cent was observed in the same backcross.

The highest success was obtained with hybrids of *Ae. caudata* (2·3 per cent), the least with

hybrids of *Ae. cylindrica* and *Ae. columnaris* (0.3 per cent). Equally good results were obtained whether the parent plant, other races of the same species or other species were used for the back-cross, the latter being sometimes more successful. The number of normal egg cells seen at reduction division was higher than these figures suggest and the low fertility is partly ascribed to the small number of individuals pollinated.
Free-flowering plants in cages with wheat or *Aegilops* plants intermixed gave an average set of 0·32 per cent and the results for the different hybrids confirmed those reported for artificial backcrossing. Only *Ae. uniaristata* and *Ae. Kotschyi* x *T. vulgare*, *Ae. triuncialis* x *T. dicoccoides*, and *Ae. umbellatum* and *Ae. ovata* x *T. durum* gave no seeds. The greater fertility of the *Ae. caudata* hybrids possibly results from some quality of the particular race of this species chosen.
In general the hybrids with *T. dicoccum* and *T. turgidum* were more and those with *T. Spelta* and *T. durum* less fertile than the *T. vulgare* hybrids.
The average germination of the seeds was 65·2 per cent ; again the *Ae. caudata* hybrids gave the best results, viz, 79·5 per cent.

624 BUCHINGER, A. 633.11:575.127.5:633.14:576.341
Lebensenergie, Sterilität und Saugkraft bei Getreide. (**Vital energy, sterility and osmotic pressure in cereals.**)
Biol. Generalis, Vienna 1931 : 7 : 275-83.
Within a number of wheat varieties studied those plants with the lowest osmotic pressure displayed the highest degree of sterility.
Six different wheats were pollinated with one and the same variety of rye, *Secale cereale* L. and the same relationship between low osmotic pressure and sterility was observed. The combinations of parents most widely differing in osmotic pressure were the most difficult to effect and gave the hybrids with the lowest osmotic pressure. In every case the hybrids were just so much lower than the female parent as the latter was below the male. Moreover, when the difference in osmotic pressure of the two parents exceeded one third of the osmotic maximum of the male or one half that of the female, the cross failed entirely.
The author's success in obtaining one reverse cross (" Plant Breeding Abstracts," Vol. II, Abst. 220) he explains by the fact that he chose the rye (high) at the latest possible stage, so as to reduce its pressure, and the wheat vice versa.
The lower osmotic difference between hybrid and wheat explains the greater success of this backcross.

625. BLEIER, H. 633.11:575.127.5:633.14:576.356
Genetische und cytologische Untersuchungen von Weizenstämmen (*Triticum vulgare*) aus Weizen-Roggen-Bastardierungen (*Triticum vulgare* x *Secale cereale*). [**Genetical and cytological investigations of wheat lines** (*Triticum vulgare*) **from wheat-rye crosses** (*Triticum vulgare* x *Secale cereale*).]
Z. Züchtung 1933 : A. 18 : 191–211.
A study of 29 of the 42 chromosome wheat-like segregates without rye characters, arising in Meister's crosses at Saratov and crosses of them with rye, *T. monococcum*, *T. dicoccum*, *T. durum* and *T. vulgare*. The highest success in 1931 was obtained with *T. vulgare* (33 per cent) and *T. durum* (29 per cent). Rye gave only 3 per cent and *T. monococcum* none at all. The 1932 results agreed substantially with these.
The hybrids are described ; those with rye were typical wheat-rye hybrids, except for the absence of hybrid vigour ; they were completely sterile. The hybrid with *T. durum* was slightly and with *T. vulgare* fully fertile. In their fertility and in other characters the hybrids resemble exactly the corresponding hybrids previously known with pure *T. vulgare*.
In the majority of cases 21 gemini were observed in these plants at the reduction division, although in 31 per cent of the cells 1—2 univalents were present ; no lagging was detectable at inter-kinesis but 15 per cent of the resulting pollen grains had one chromosome short or one too many. Such pollen grains do not function. These irregularities are not more than those occurring in hybrids between different varieties of *T. vulgare* which were observed at the same time and which shewed exactly similar phenomena.

The reduction division of the F_1 hybrid with rye is described. Three quarters of the cells contained 28 univalents only, some contained bivalents and some occasionally trivalents. The occurrence of bivalents in haploid wheat leads the author to regard the bivalents and trivalents here as due to autosyndesis of the wheat chromosomes. Their number is no greater than that described by other investigators for true wheat-rye hybrids.
Up to early metaphase the univalents make no independent movements but lie or move absolutely passively. Those which have not moved to the poles in this way at the stage of longitudinal division suddenly divide and the halves move to the poles. If this is very late they may form micronuclei and extra cells. In no case was division of all the univalents or the formation of restitution nuclei observed.
In the second division only those chromosomes which did not divide in the first engaged in independent movement. The pollen was entirely sterile.
In the hybrids with *T. durum* 79.5 per cent of the metaphase figures had 7 univalents and 14 bivalents, certain had 9 or 11 univalents and two cases of trivalents were observed. Rather more than half the univalents divided in the first division. The whole behaviour was exactly similar to that of normal *T. durum* x *T. vulgare* crosses.
The identical behaviour corresponding in all respects to that of pure *T. vulgare* leads to the conclusion that all trace of the rye chromosomes has gradually disappeared and any difference between these plants and the original wheat is the result of out-pollination with wheat and not the influence of the rye parent. This and the absence of crossing-over between the chromosomes makes any practical result from these crosses highly improbable. The only value of wheat-rye crosses is in the possibility of producing fertile amphidiploids, for which purpose no backcrossing with either parent should be done.
The absence of gemini in wheat-rye hybrids would seem to deny any contribution of rye to the origin of wheat, beyond the enhanced variability which results from hybridization.

626. HACIZADE, M. 633.11:575.73:575.127
Ueber die Ursachen der " Entartung " des Weizens. (**On the causes of degeneration of wheat.**)
Züchter 1933 : **5** : 30–34.

The fact that in Turkey fields of wheat frequently comprise 3—4 species and 7—8 varieties offered special facilities for this study of the cause of degeneration in wheat.
Observations made in southern Turkey shewed that degeneration accompanied by greatly reduced fertility was frequently due to (1) species hybrids—with the same or different chromosome number ; (2) crosses of different lines within a species. The latter occur very frequently and result in the segregation of inferior progeny. In addition to these two factors a process of natural selection also plays a part, tending as it does towards the elimination of those superior lines to which, if they are to continue unaltered, certain environmental conditions are essential.

627. SABASHNIKOV, V. 633.11–2.111–1.521.6(57)
(**The problem of winter wheat in Siberia.**)
Bull. Appl. Bot. Leningrad 1932 : Ser. 2 (3) : 119–35.

The difficulties encountered in the attempt to introduce winter wheats into Siberia are outlined, the various factors which influence success being discussed. Side by side with rigid selection of the most cold-resistant varieties the solution to the problem is to be sought for in interspecific crossing and the selection from the progeny of constant forms by growing the progeny in regions favourable to winter wheat.

628. CLARK, J. A. 633.11–2.451–1.521.6:575
Wheats bred for smut resistance combined with yield and quality.
Yearb. U.S. Dept. Agric. 1932 : 403–04.

The testing of the resistance of wheat varieties is complicated by the occurrence of physiological forms within the two species of the smut fungus. Some varieties which are resistant to all the strains or some of them are mentioned. The inheritance of immunity has been found to be comparatively simple. Crosses have been made in order to combine smut resistance with high yield and quality and rust resistance. Of those hybrids produced, Ridit for one is already extensively grown.

629. 633.11–2.451.3:576.16
(Influence of different sources of spores of *Tilletia tritici* and *T. levis* on the infection of wheat by bunt.)
Diseases of grain crops, Omsk Inst. grain crops, 1932 : 4–14.
In any variety, much greater infection was produced by spore material cultured on that particular variety—even *T. dicoccum* and *T. durum* var. *hordeiforme* 010 being infected. The increase in virulence sometimes occurred quite suddenly.
This leads to the conclusion that not only selection of physiological forms but the origin of new ones by hybridization and mutation are at work.

630. Flor, H. H. 633.11–2.451.3:576.16:575.12
Wheat bred to resist some strains of bunt may succumb to others.
Yearb. U.S. Dept. Agric. 1932 : 392–93.
It was observed that Marquis wheat, which for years has been resistant to bunt, has lately suffered severe attacks. This is explained by the fact that new strains of smut appear spontaneously or by way of hybridization, which has proved to be possible between two strains of the same smut species or even the two species themselves.

631. Bressman, E. N. and Harris, L. E. 633.11–2.451.3–1.521.6:575.11
Inheritance in Albit wheat of resistance to bunt, *Tilletia tritici*.
J. Agric. Res. 1933 : 46 : 361–65.
The wheat hybrid Albit resembles its x parent, White Odessa, in resistance to certain forms of *Tilletia tritici* and its ♀ parent, Hybrid 128, in morphological characteristics. Hybrid 128 apparently carries no factors for resistance to bunt. An analysis of four families (5,000 plants) in an F_3 from a Hybrid 128 x Albit cross indicated that resistance was probably segregating as a monohybrid character. In opposition to Briggs, the authors believe that White Odessa has only one factor pair for resistance (MM) which determines the resistance of the plant only to certain physiological forms of bunt and that this identical factor has been transmitted to the segregate Albit.

632. 633.11–2.451.3–1.521.6:575.11
Clark, J. A., Quisenberry, K. S. and Powers, LeRoy 633.11:575.11
Inheritance of bunt reaction and other characters in Hope wheat crosses.
J. Agric. Res. 1933 : 46 : 413–25.
A study was made of inheritance of resistance to bunt (*Tilletia levis*) and of other characters in the F_3 from the crosses of Hope x Ceres, Marquis and Hard Federation. Hope was highly resistant (2·1 per cent of bunted plants on infection), Marquis was weakly resistant (44 per cent bunted plants), Ceres was weakly susceptible (64 per cent bunted plants) and Hard Federation strongly so (81·7 per cent bunted plants). The Hope x Hard Federation shewed a strong tendency towards dominance or preponderance of susceptibility, probably conditioned by several factors. Hope x Ceres shewed intermediate inheritance in F_3 and at least two factors appeared to be involved. Hope x Marquis shewed dominance of the superior resistance of the Hope parent. In general the results shewed that the higher the degree of resistance involved, the less complicated is the inheritance and as the degree of resistance increases a gradual change occurs from imperfect dominance of susceptibility to imperfect dominance of resistance.
The Hope x Hard Federation cross also shewed that the correlation of the percentage of bunt and the percentage of infected plants is positive ($r = 0{\cdot}741 \pm 0{\cdot}029$) but between percentage of bunt and average yield negative ($r = 0{\cdot}554 \pm 0{\cdot}045$). Incidentally glume colour was shewn to be probably due to a single factor difference, grain colour to at least three factors, and awnedness to possibly two major factors though its expression was rather variable and environmental effects rendered the investigation of possible further factors impossible. No consistent relation was found between awnedness on the one hand and bunt or yield per plant on the other.

633. 633.11–2.452 *P. glumarum*
STRAIB, W. 633.11–2.452 *P. glumarum*–1.521.6:575
Ueber Gelbrostanfälligkeit und –resistenz in den verschiedenen *Triticum*–Reihen. (**Susceptibility and resistance to yellow rust in the different groups of *Triticum*.**)
Z. Züchtung 1933 : A. **18** : 223–40.

Wheat sorts representing all the different species, and numbering 290 in all, were tested against 14 forms of the fungus and the results are tabulated.

In both *T. monococcum* and *T. aegilopoides* highly susceptible as well as highly resistant races were observed, different botanical varieties tending to display a characteristic reaction. Similarly *T. dicoccoides* contains varieties resistant and others susceptible to certain fungus forms.

In *T. dicoccum* one group, containing sorts from nearly all varieties, proved fully susceptible, one variety was fully resistant and others were susceptible to certain forms and not to others. Vavilov's division of this species into a resistant and a susceptible group applies to forms 9—13, not however to other forms.

The other 28 chromosome wheats also contained both resistant and susceptible groups.

T. Spelta contains a relatively large group of fully susceptible varieties and in the other groups susceptible sorts preponderate. One sort of the variety *album* was resistant to all forms. The position was much the same also in *T. compactum*, except for one group resistant to forms 10—14 and susceptible to 1—9. No fully resistant variety was observed.

The majority of German sorts of *T. vulgare* are susceptible to the fungus forms occurring in Germany though often resistant to others. Form 9 divides the sorts into two clear groups, one resistant, the other susceptible, the latter containing all spring wheats.

The yellow rust reaction, therefore, has no strict diagnostic value, exactly corresponding in this respect to the position in other rusts and other cereals.

Moreover, even in interspecific crosses it is necessary to study the reaction of both parents before starting to breed for resistance.

634. KOCZOR, F. and PAP, L. 633.11:664.641.016
Vergleich der verschiedenen Methoden zur Bestimmung der Backfähigkeit von Weizenmehlen. (**Comparison of various methods for determining the baking quality of wheat flours.**)
Arch. Pflanzenbau 1932 : **9** : 659–85.

Substantially the same as the Hungarian version* referred to in "Plant Breeding Abstracts" Vol. II, Abst. 419.

635. BOERGER, A. 633.11:664.641.016(89)
Experimentelle Müllerei und Bäckerei in La Estanzuela, der Landesanstalt für Pflanzenzucht in Uruguay. (**Experimental milling and baking at La Estanzuela, the state institute for agronomy in Uruguay.**)
Z. Züchtung 1933 : A. **18** : 241–58.

An account is given of the struggle to make the growers cultivate high-quality wheat and of the equipment of the research laboratory.

In his remarks on the problems and difficulties of baking tests, the author emphasizes the interaction of hereditary and environmental factors in determining baking quality, and points out that the latter may even in certain years overshadow the former.

Experiments carried out in Uruguay have failed to detect any marked influence of nitrogenous manuring on quality. Other experiments have shewn that the quality of a variety can often be greatly enhanced by mixing with it small proportions of another, whereby the quality of both lines is raised. As a result of this phenomenon the value of a high-quality variety may be made still higher by admixture of flour from a distinctly inferior variety.

The necessity of standardization in the wheat for export purposes is emphasized.

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* A full translation of which is on file at the Bureau.

636. 633.11:664.641.016:575
Diskussion über die Vortragsserie: Weizenzüchtung auf Qualität und Beeinflussung durch äussere Faktoren. (**Discussion on the series of papers: Wheat breeding for quality and the influence of external factors.**)
Bericht über die Diskussionstagung Weizen– und Weizenmehlqualität, Universität Halle a.d.S., 27 and 28 Jan. 1933: 63–64. Hans Kunis, Leipzig.
Dr. Åkerman referred to the efforts of the Swedish spring wheat breeders to combine the high protein and gluten content of Diamant with the gluten quality of Extra Kolben. He also confirmed the statement that differences exist between varieties in tendency to sprout. Professor Baur remarked that sprouting is to a certain extent connected with loose glumes; also that a considerable achievement would have been attained by breeders if all the third grade wheats could be even replaced by second grade.

637. Lee, van der 633.11:664.641.016:575
Erfolge der Mehlbehandlung in Verbindung mit Weizenzüchtung auf Qualität. (**Achievements of treatment of flour in relation to breeding wheat for quality.**)
Bericht über die Diskussionstagung Weizen– und Weizenmehlqualität, Universität Halle a.d.S., 27 and 28 Jan. 1933: 26–28. Hans Kunis, Leipzig.
The author stresses the fact that the quality can nearly always be increased by artificial treatment of the flour and that the high quality limit attained by breeding can, whatever it be, still further be raised by appropriate treatment. Since some varieties react much more than others to treatment, it is desirable to take the quality after treatment as the criterion in breeding.

638. Roemer, T. 633.11:664.641.016:575
Ziele und Wege der Weizenzüchtung. (**Objects and methods of wheat breeding.**)
Bericht über die Diskussionstagung Weizen– und Weizenmehlqualität, Universität Halle a.d.S., 27 and 28 Jan. 1933: 57–59. Hans Kunis, Leipzig.
Sufficient yield increase having been already brought about by breeding, it remains now to improve the quality (including a reduced tendency to sprouting), to raise the resistance to diseases and unfavourable climatic conditions, thereby reducing fluctuations in yield, and to increase the resistance to lodging.
With regard to quality breeding it is very necessary if possible to have some criterion of quality, which will not change during the protracted period required for the breeding operations (10—15 years). These criteria must be such that small samples of breeding material can be tested with accuracy and so permit large quantities of material to be tested at a low cost. It is in these respects that quality breeding is wanting, not in the breeding technique itself.
Gluten quality is less influenced than quantity by external conditions and is therefore of primary importance. Gluten quality has been shewn to depend on a number of factors, which have been shewn to be independent of other desirable characters such as yield, strength of straw and disease resistance.

639. Neumann, M. P. and Strube, J. 633.11:664.641.016:578.08
Weizenqualität und Kleberquellung. Wert der Methode Berliner. (**Wheat quality and swelling of gluten. The value of Berliner's method.**)
Züchter 1933: 5: 54–61.
A method of testing the quality of grain in small quantities is the *sine qua non* of successful quality breeding. Berliner's method consists in breaking 2·5 g. of washed gluten into about 70 pieces and standing in $\frac{n}{50}$ lactic acid at 27°C. The volume reached after 2½ hours divided by 2·5 is the "swelling coefficient."
The results of such tests on flour from a number of varieties were compared with baking tests. The correspondence was very good, though not perfect in the intermediate values and certain varieties had very high swelling coefficients but gave unsatisfactory baking tests. Other

varieties which industrially, apparently after treatment, produce excellent bread, were deficient in both these series of tests.
It is emphasized that the swelling coefficients give purely relative values and very little reliability is to be placed on the absolute figures.
The differences observed in the same group of spring varieties grown in different districts also shewed considerable agreement in swelling and baking tests. On the other hand with a group of winter wheats from different sources, shewing wide variations in the swelling coefficient, which evidently resulted from environmental influences, no clear correspondence could be established between these and the baking tests.
The necessity of a standard method of extracting the gluten is stressed and the recommendation made that even when only small quantities of grain are available a flour should be used rather than bruised grain. Although considerable improvements in the method are possible, its use in breeding, even if only as a subsidiary method, is advocated. From a cross of high x low quality wheats, segregates giving coefficients varying from 27·0 to 13·0 were obtained.

640. BERLINER, E. 633.11:664.641.016:578.08
Ueber " Schrotkleberprüfung " und " Mehlkleberprüfung." (**Testing gluten on " bruised grain " or on " flour."**)
Mühlenlaborat. Lpz. 1933 : **3** : 87–96.
Reference is made to the article by Neumann and Strube (see above abstract) and various factors are enumerated which make it impossible from a small quantity of grain to produce flour always of identical quality and nature, especially in respect of ash constituents. From this point of view, therefore, the bruised grain is to be preferred.
A case is quoted of a wheat with a swelling coefficient of 19·5 for the bruised grain, whilst the coefficients varied from 23 to 12 for the flour. Recent experiments extending over a number of years have shewn that while the quality of the flour varies with its method of preparation, that of the bruised grain is much more nearly constant. With increasing fineness of milling the embryo and aleurone cells are damaged, and set free materials which injure the quality of the gluten.
Various remarks are given on the method and directions in which it has or could be modified. For testing the quality of the wheat the bruised grain method, while for the quality of an individual flour the flour method, should be applied.

OATS 633.13

641. 633.13:575.242:576.356.4
NISHIYAMA, I. 633.13:576.354.4:575.11
The genetics and cytology of certain cereals. IV. Further studies on fatuoid oats.
Jap. J. Genet. 1933 : **8** : 107–24.
A report is given of a further generation of segregates from heterozygous fatuoids of the b type of series II. On account of the rather high degree of sterility of the heterozygotes successive generations shew a fall in the number of heterozygous segregates, with a corresponding rise in fertility. The number of normals segregating remains the same, the homozygous fatuoid increase in number. A certain amount of competition occurred in favour of 21 chromosome pollen grains as opposed to those with 20.
In addition to the ordinary types certain homozygous fatuoids with one large fragment of the c chromosome appeared. These were distinguished from the ordinary homozygous fatuoids in having 20 bivalents and low fertility.
Their progeny contained similar plants, ordinary homozygous fatuoids and some with two large fragments. These closely resembled the ones with one fragment.
Certain heterozygous fatuoids with 40I and one small fragment displayed nearly entire sterility and failure of synaptic mating, just as the homozygotes with 40 chromosomes. This fragment is thought to be the smaller arm of the c chromosome.
From the homozygote with one large fragment pollinated with normal pollen heterozygotes with 20II + c and one with 20II + large fragment were obtained. This fragment corresponded in

size and in spindle attachment to the long arm of the c chromosome, with which it paired and plants of this type were morphologically distinguishable from those with the shorter fragment. Others of the possible combinations of chromosomes and fragments have not yet been observed. These observations shew that by fragmentation of the chromosome the linkage between grain base type and synaptic character is broken, the former being carried by the short and the latter by the long arm. Certain other characters also appear to reside in the short arm.

The author argues from his observations that the aberration hypothesis for the fatuoids of series I is untenable ; no mating of the b and c chromosomes has been observed in 41 chromosome heterozygous fatuoids, which rules out the formula $\frac{abc}{abb}$; no synapsis occurs in absence of C, thus the formula $\frac{abb}{abb}$ is also rejected. The evidence so far at hand proves linkage of the *sativa* characters but not necessarily of the *fatua* characters which are regarded as hypostatic and may thus be in separate chromosomes.

Observations of a similar nature were made on material received from Huskins and further details will be published later.

RYE 633.14

642. Åkerberg, E. and Ericson, H. 633.14
Original Petkusråg och Weibulls original Självbindareråg. [**Original Petkus rye and Weibulls original Självbindare (self-binding) rye.**] Priskatalog med Sortbeskrivningar å Utsäden fran W. Weibull A.B. Landskrona 1932 : p. 11.

Självbindare rye originated by selection from the progeny of a cross between two pedigree lines originally isolated from Petkus. Its uniformly short straw allows it to be harvested without hinderance.

Petkus rye has been introduced from Germany and included in variety tests with certain of its newly isolated strains.

MAIZE 633.15

643. 633.15:575.11.061.6
Yasui, K. 633.15:575.11–181.13
(**Genetical studies in *Zea mays* L.**)
Bot. Mag. Tokyo 1933 : 47 : 138–45.

A strain from a Japanese variety of maize called Shirokibi, characterized by white flint grain on selfing gave a monohybrid ratio of 14 tall to 27 dwarf. The dwarfs were mainly andromonoecious and had a chromosome number of 2n=20 like the tall type.

A number of yellow individuals with leaves containing yellow pigments and very small quantities of chlorophyll in the form of citron yellow grains segregated out in the I_2 of a pedigree strain (No. 582). This condition which results in early death of the plants appears to be due to a pair of allelomorphs semi-lethal in the homozygous condition.

A variety called Odaishikibi with a light purple ear yielded an I_1 containing plants with indigo-purple, yellow, and white grains ; while I_2 shewed 6 groups of plant types, only one of which, (group 3) which gave indigo-purple and white, is considered in the present paper. This type gave two ratios, 3 indigo-purple : 1 white and 9 indigo-purple to 7 white, the latter containing different shades of indigo-purple but the former, in the instance cited, not. It is concluded that the difference between indigo-purple and white is determined by either one or two factor pairs. The apparent difference in dominance in the two ratios is regarded as an environmental modification.

644. SMITH, G. M. 633.15:575.12

Golden Cross Bantam sweet corn.

Circ. U.S. Dept. Agric. 1933 : No. 268 : Pp. 12.

Golden Cross Bantam is a single cross hybrid produced by controlled pollination of two inbred strains of yellow sweet corn, Purdue Bantam by Purdue 51. The new hybrid is comparatively early maturing and of high quality, gives a high yield and is markedly resistant to bacterial wilt (*Aplanobacter stewarti*). It has been shewn to be adapted to a wide range of soils and to be capable of withstanding drought, and also high temperatures during ear formation. Yield trials have shewn a yield of 3·84 tons green corn per acre. Under good conditions the ears are remarkably uniform in size and shape.

645. DETURK, E. E., HOLBERT, J. R. and HOWK, B. W.

633.15:575.12:581.19

Chemical transformation of phosphorus in the growing corn plant, with results on two first-generation crosses.

J. Agric. Res. 1933 : 46 : 121–41.

Some inbred lines of yellow dent maize were found to respond differently to application of phosphate fertilizers. This paper represents a preliminary investigation of the distribution of phosphorus throughout the plant during various stages of development in open-pollinated plants and in two first generation crosses which shewed a difference in response to application of phosphorus.

Phytin phosphorus first appears in the developing seeds, it is absent from all parts of the plant before pollination and disappears from the seeds during germination. The first generation crosses were grown in phosphorus deficient soil, with and without superphosphate manure, the phosphorus was analysed in four fractions, one inorganic and three organic, at five stages of growth.

Slight differences were noted in the proportions of inorganic phosphate and acid-soluble organic phosphorus between the crosses when the plants were grown without adequate phosphorus, but no satisfactory explanation for the difference in response to the phosphorus manure has been yet found.

646. 633.15:575.125

Hybrid corn varieties produce highest yields.

J. Hered. 1933 : 24 : p. 64.

Co-operative maize experiments in eastern Nebraska shewed that out of 35 open pollinated varieties and hybrids the 18 highest producers were hybrids. The 5 best hybrids averaged 67·88 bushels per acre and the 5 best open pollinated varieties 52·22 bushels and the average for all hybrids was 59·07 bushels per acre or nearly 7 bushels more per acre than the corresponding average for the open pollinated varieties. The hybrids also proved superior in strength and uniformity of stalk, height and type of ear and general grain quality.

647. HUMPHREY, L. M. 633.15:576.312.35

Chromosome studies in *Zea mays* L.

Amer. J. Bot. 1933 : 20 : 290–95.

Observations are recorded of the chromosome numbers of the "maize testers" used at the Minnesota Agricultural Experiment Station. The material is recorded under the ten linkage groups as summarized by Emerson. Determinations were made of both the haploid and the diploid number.

In all but one group, the A tester of Emerson, (A-TS_4 and B-LG) the number was 10 haploid. In the exceptional group this number was 11, with $2N = 22$. It is noteworthy that, in a cross using this tester, deviations from the expected 3 : 1 ratio for purple to red seeds had been obtained by Hayes and Brewbaker, which those authors were convinced was not due to linkage. Among the 48 counts made in Bantam Evergreen, one gave a diploid number 26, all other counts being normal.

648. EYSTER, W. H. 633.15:581.174:575.11
Plastid studies in genetic types of maize: argentia chlorophyll.
Plant Physiol. 1933: 8: 105–21.

The argentia chlorophyll pattern produces a silvery appearance of the leaves and is due to the more rapid development of the chloroplastids adjacent to the vascular bundles, pigmentation in other cells of the leaf being developed late or not at all. This pattern is determined by a simple Mendelian recessive situated in the C-Sh-Wx chromosome and probably linked with waxy endosperm, with 10·8 per cent of crossing over. The relation between the condition and plastid development has been investigated, and from a study of the chloroplastid pigments in affected plants it is deduced that the gene for argentia pattern inhibits the development of all the types of pigments and not only of chlorophyll. The argentia condition is affected by temperature.

649. FRASER, A. C. 633.15:581.466:575.11
Heritable characters of maize, XLIV. Silky ears.
J. Hered. 1933: **24**: 41–46.

The condition termed "silky ears" is characterized by the production of a profusion of silks rather firmly attached to the ears. The general effect of the silky gene or genes is apparently to render the plant almost entirely pistillate, at least as regards function. From crosses of silky ears (si_1) with normals it is assumed that the silky type differs by a simple recessive gene; si_1 belongs to the Y-Pl linkage group.

Silkies obtained from two other sources were found to be genetically identical and phenotypically indistinguishable and represent a second type of the condition. In this second type the silky character when less marked consists in masses of glume-like material matted together and producing many silks and occurring at several places in the ear; but when the condition is very pronounced these anomalies of tissue and silks are distributed all over the whole ear. The pollen in the second type of silky is much more abundant than in the first type (si_1). In some cases the silky character displayed imperfect recessivity and its expression was influenced by environment. The genetical analysis is still in progress.

650. EDDINS, A. H. 633.15-2.412.5
Infection of corn plants by *Physoderma zeae maydis* Shaw.
J. Agric. Res. 1933: **46**: 241–53.

The paper describes a number of experiments with 'brown spot'; a disease produced by *Physoderma zeae-maydis* and responsible for much damage to corn in the southern States. All varieties of *Zea mays* tested as well as *Euchlaena mexicana* proved susceptible and a list of other plants tested and found immune is given.

A description is given of the symptoms and of a number of inoculation experiments both in the greenhouse and field. There is a differential resistance capacity under these two conditions which is dependent on the variety. Though different strains of corn shewed wide differences in susceptibility these differences did not remain constant from season to season. By inbreeding it has been possible, however, to isolate resistant strains.

BARLEY 633.16

651. KUCKUCK, H. 633.16:575.11 "793"
Ueber die Entstehung von Wintergersten aus Kreuzung von Sommergersten und über die Beziehungen der Winterfestigkeit zum Winter-Sommertyp.
(On winter barley arising from crosses of spring barleys and on the relation of cold resistance to the winter-spring type.)
Z. Züchtung 1933: A. **18**: 259–90.

Reference to the literature and the experiments on the parental varieties shewed that various factors such as low temperature in spring, length of day and moisture influence earing. Both parents were early spring forms, possessed of a certain degree of hardiness; this was not such however as to include them in the "alternative" barleys. The one, H10, displayed the same habit when sown either in spring or winter, the other, H13, in winter sowings was markedly procumbent. The former eared under reduced day (12 hours), the latter did not.

An F_2 between these two, consisting of 385 plants sown in spring, contained 44 procumbent individuals ; pronounced transgression for time of flowering also occurred. Some of the procumbent plants gave spring types in their progeny although the procumbent type always predominated ; they were thus not all simple recessives but evidently of a more complicated nature ; all the upright F_3 segregates which flowered before a particular date bred true, those flowering later segregated for habit, the decisive date being different for different families.

An attempt was made to explain the results on a three factor basis but the examination of the F_4 and later generations indicated that the position was more complicated ; an F_4 with 40—50 per cent procumbent plants was particularly difficult of explanation.

The F_4 progeny of an upright early F_3 plant were all susceptible to cold but in the F_4 from late F_3's of the winter type of growth hardy plants appeared. The percentage survival in the later generations was considerably higher than in the two parents, e.g. in F_6 37 per cent as compared with 14·2 per cent for H13 and 0 for H10. This is ascribed to the combination of resistance factors brought in by the respective parents. The hardy segregates were derived only from late procumbent plants and all shewed a tendency not to ear when spring sown. No early pure spring type displaying resistance was obtained.

These two barleys were also crossed with H77 (winter) and H62 (spring) barleys. The F_1 of H13 with H77 was more or less like the latter in type and time of flowering, the F_1 of H10 with the same barley was intermediate in type and early. The time of maturity of the two hybrids is thus influenced by that of the spring parent. Both hybrids with H62 were normal spring early forms.

In the F_2 the H77 x H13 hybrids gave a greater survival percentage (46·3) than those of H10 (10·8). This cross again demonstrates the correlation between lateness and hardiness, since the H13 progeny also contained a much higher proportion of procumbent winter types when spring sown (77·5—81·7 per cent as compared with 54·6—57·4 per cent). Also the F_2 from H62 had more procumbents when H13 (7·7 per cent) was used than with H10 (1·5 per cent) and both the degree of procumbency and the number of plants which failed to ear were more pronounced. The variation in time of flowering was greater in the F_2's from H13 than in those from H10.

The F_3 of H13 x H77 was sown in spring from F_2 plants sown in winter and proved to be nearly entirely procumbent. Out of 34 families, 4 consisted entirely of spring forms, 6 entirely of procumbent forms that failed to ear, and 24 segregated into both, with a majority of winter forms. This points to a selection, resulting from the winter sowing of the F_2, of hardiness together with the winter growth habit. To test this F_3's were grown from F_2 plants sown in spring ; this F_3 contained 12 entirely spring families and 15 segregating into all conceivable ratios of spring and winter ; the former came exclusively from early F_2 plants, only one of which gave a segregating progeny. Here again the number of winter segregates clearly increased with the lateness of the parent plant.

In a similar F_3 from an F_2 in which owing to conditions of growth only 45 per cent of the plants had eared, nearly all families contained spring forms only. Spring sowing hence effects a selection for early earing. Moreover after spring sowing the spring type is seen to be dominant, after winter sowing the winter type is dominant.

The F_4 derived from the spring-sown F_2 was more variable and on an average less hardy than that from the winter-sown F_2 (75·9 per cent survival as compared with 85·5 per cent) from which it is again argued that selection of early flowering plants and consequent loss of the late forms has also resulted in a loss of the most hardy forms.

The cross H77 x H10 gave similar results in F_4, except that no dominance of the winter type was observed, the number of winter types was less and the degree of hardiness was less. Early and late flowering F_3 plants were chosen and the F_4's from the latter again shewed significantly greater hardiness than those from the former. The author concludes from all these observations that winter habit, hardiness and late earing are all closely correlated and cannot be regarded as distinct phenomena as some authors have done. Cold resistance is regarded as the best criterion of the different types.

A similar alteration in proportions of spring and winter types according to time of sowing of the parent generation is detected by reference to work of Schiemann in barley and certain other workers in wheat.

In these experiments all stages between the pure winter and the pure spring type were observed, as also between fully susceptible and very resistant. Thus the designation " alternative form " is a purely relative term, the particular intermediates embraced by it depending entirely on the conditions of cultivation. The variation in behaviour according to conditions also makes the genetic classification very much more difficult.

652. ROBERTSON, D. W. 633.16:575.113.7:575.115
The effect of a lethal in the heterozygous condition on barley development.
Tech. Bull. Col. Agric. Expt. Sta. 1932 : No. 1 : Pp. 12.

The author has studied the effect of the lethals A_c, X_b, A_h and A_{t2} conditioning chlorophyll deficiency when duplex and found in Colsess, Black Hulless, Hanna and Canada Thorpe barleys respectively. A_{t2} also affects the endosperm. No significant differences (attributed to lethal action) were found between normals and heterozygotes for the various genes as regards number of culms per plant, average length of culm and of head, number of grains per plant and total weight of grain per plant, except in Canada Thorpe in which the lethal is associated also with a watery endosperm and the total grain weight was significantly lowered in the heterozygote.

653. WEXELSEN, H. 633.16:575.116.1
Linkage of a quantitative and a qualitative character in barley.
Hereditas 1933 : **17** : 323–41.

An effective method of analysing a quantitative character by means of linkage between it and a qualitative character is demonstrated by the investigation of rough and smooth awn and length of internode of the rachis in barley.

The rough-smooth awn character shewed monofactorial segregation. A rather close correlation between long internode and smooth awn made it possible to trace one of the internode factors in the segregations. The difference in internode length is probably due to the action of two factors with about equal effect ; and the effect in the heterozygous condition is about half that in the homozygous state. One of these factors shews about 10 per cent crossing-over with the awn factor. There are indications of the presence of a third factor.

654. ROBERTSON, D. W. 633.16:575.116.4
Inheritance in barley.
Genetics 1933 : **18** : 148–58.

The following pairs of characters were studied in various crosses : Non-6-row and 6-row, (Vv) ; Black and White glumes, (Bb) ; Hulled and naked caryopsis, (Nn) ; Hoods and Awns, (Kk) ; Intermedium (or low fertility) and Non-intermedium, (Ii) ; Long and Short haired rachilla, (Ss) ; Green and White seedlings, (Aa) ; Green and Yellow seedlings, (Xx) ; Green and Chlorina seedlings, (Ff) ; and finally Purple and White straw colour, (Prpr). Each of the factor pairs Ii, A_ba_b (in Black Hulless) and Prpr shewed simple Mendelian ratios. As regards linkage relationships, Ii was found to be linked with Kk, with 15·12 ± ·065 per cent crossing-over ; Vv and Ii were not linked, while A_ba_b was linked with Ss but not with Kk and Nn ; and finally Pr shewed linkage with Vv. A seventh linkage group containing F_cf_c was discovered, and Ii, A_ba_b and Prpr were shewn to be included in the linkage groups IV, V and I respectively.

655. SCHULZ, K. G. 633.16:575.73
Besteht beim Braugerste eine Abbaugefahr ? (**Is there a danger of degeneration in malting barleys** ?)
Fortschr. Landw. 1933 : **8** : 127–30.

Experiments of various workers are quoted which shew that under proper conditions no loss of quality or genotypical change of any kind occurs from one generation to the other. Outpollination in barley is of such extreme rarity that impurification from this cause is almost non-existent.

Mention is made of the characteristic capacity of barley to modify its properties according to conditions of cultivation, which modifications, however, are in no way hereditary.

656. INOUYE, C. 633.16:576.354.4
Meiotic mitosis in *Hordeum sativum*.
Bull. Miyazaki Coll. Agric. and For. 1933 : No. 5 : 77–96.
A minute description (with illustrations) is given of the various stages of meiosis in 2-rowed and 6-rowed varieties ; the achromatene stage and the function of the nucleolus and its relation to the spireme are discussed. The concentration of the spireme at the pole of the nucleolus, at various stages, considered with other data, is interpreted as indicating that the nucleolus is the source of the material for the chromosomes. No differences were observed in the 2-rowed and 6-rowed varieties. The haploid number 7 was confirmed.

SORGHUMS 633.17

657. FINNELL, H. H. 633.174
New varieties of grain and forage sorghums.
Bull. Panhandle Agric. Expt. Sta. 1933 : **47** : Pp. 8.
Includes an account of their origin and performance in variety tests.

658. STEPHENS, J. C. and QUINBY, J. R. 633.174:581.162.32:578.08
Bulk emasculation of sorghum flowers.
J. Amer. Soc. Agron. 1933 : **25** : 233–34.
A simple and at present crude, though effective, method is described, whereby the pollen is killed on the head by the application of hot water without too seriously damaging the other parts of the flower.

RICE 633.18

659. 633.18 Shoemed
BREWER, C. A. 633.18:575.42"793"
" Shoemed " rice is early variety released at Crowley.
Rice J. 1932 : **35** : p. 14.
A variety selected from a sample received in the Philippines in 1926. It ripens only a few days after Early Prolific, in 113—118 days. The yield appears satisfactory.

LUPINS 633.367

660. LIBKIND, B. M. 633.367
(Lupin.)
Lenin Acad. Agric. Sci., Inst. Pl. Ind., Leningrad 1931 : Pp. 164.
The extreme antiquity of the plant in cultivation is pointed out and various views as to the origin of it are mentioned, with quotations from classical latin authors on its uses.
The author observes that, in contrast with the lupins of the Old World, those of the New World, where about 200 species exist, are adapted to the widest range of ecological conditions, even into the alpine zone, up to 4,500 m. The greatest wealth of wild species is found in the Cordilleras, from Oregon and California to the Peruvian Andes. In Europe only 9 species are known.
The geographical distribution of the cultivated lupin is also discussed. These are mostly Old World forms. The crop is destined to play a large part in the future of Soviet agriculture, especially if suitable early forms for seed production are found.
Botanical descriptions of the plant and reproductive organs are given, followed by a discussion of the botanical variation observed within the Old and New World groups. The former are mostly annual, lowland, large-seeded forms, the latter mostly of the opposite type. Brief descriptions then follow of the main species and their varieties, with illustrations and a key for their determination.
In the remarks on the uses of lupins attention is called to the extreme importance of the discovery of alkaloid-free forms in certain species, e.g. *L. luteus* and *L. pilosus*.
In this respect the species *L. polyphyllus* deserves special attention, on account of its being also perennial and frost resistant.

The main problems for the breeder are the production of early resistant forms which will produce seed in northern regions ; of forms with high yield of seed and green material ; of alkaloid-free forms and of forms suitable for fodder. Brief indications are given of the method of breeding, the entire failure of interspecific hybridization being mentioned. Both in yield of green matter and of seed *L. luteus* and *L. angustifolius* are promising objects of breeding. Forms giving a uniformly high yield independent of variations in weather conditions are also highly desirable ; especially those with a low degree of seed shedding.
Some of the perennial species, e.g. *L. venustus*, *L. pubescens*, are very early maturing ; the earliest of all lupins is *L. hirsutus* var. *microcanthus*, the latter having been known to complete its vegetative period in 76 days. Most other species, including *L. luteus* and *L. angustifolius*, contain both early and late forms.
The inheritance of a number of characters in the genus has been examined in the author's laboratory and various characters whose inheritance has been established are enumerated. *L. luteus* and *L. angustifolius* are the only two on which breeding has been done but other species, both New and Old World, will be included in future work.

ROOTS AND TUBERS 633.4

661. MUNERATI, O. 633.41:575:581.143.26.035.1
Tre generazioni di *Beta vulgaris* L. nello spazio di un anno. (**Three generations of *Beta vulgaris* L. within a year.**)
Ann. Sper. Agr. Roma 1930 : 3 : 133–35.
The first seed was sown in a greenhouse in January in continuous light (1,000 watts per square metre at night) and ripe seeds were harvested after 70 days. These were sown under the same conditions and in two months seed from these plants was mature. The seed sown during the summer months suffered from the intense heat, but when sown again in September, ripe seed was collected from the plants in November.

662. MUNERATI, O. 633.41:575.242:575.127
Brusca apparizione di soggetti anomali nelle discendenze derivate da incrocio tra tipi diversi di barbabietole. (**Sudden appearance of anomalous individuals in the progeny derived from a cross between three different types of beet.**)
Z. Züchtung 1933 : A. 18 : 370–71.
In the second generation of a cross between sugar beet and forage beet syncotyly, tricotyly, partial or complete, and plants with ascidian cotyledons occurred. They are ascribed to a common cause. The latter type died, the others gave rise to normal individuals.

663. MUNERATI, O. and COSTA, T. 633.41:575.242:575.127
Due singolari anomalie in *Beta vulgaris* L. (**Two curious anomalies in *Beta vulgaris* L.**)
Z. Züchtung 1933 : A. 18 : 372–74.
In the second generation of a cross of sugar beet x forage beet individuals appeared with small foliar processes on the cotyledons. The progeny of such anomalous plants contained large numbers of aberrant types.
Crosses between tricotyledonous individuals referred to in the foregoing paper gave certain plants with hypertrophied cotyledons. These invariably perished. The normal individuals of the same progeny gave large proportions of aberrants in following generations.

664. TJEBBES, K. 633.41:576.16
The wild beets of the North Sea region.
Bot. Notiser 1933 : 305–15.
In view of the great diversity of combinations of characters found in the wild beets of the Mediterranean and Atlantic shores *Beta maritima* L. and *B. vulgaris* L. must be regarded as constituting one polymorphic species. Nevertheless one type of wild beet, found on the shores

of the North Sea and adjacent waters, does approximate rather closely to the taxonomist's definition of *B. maritima*. This North Sea type is an ecotype exhibiting several physiological and anatomical adaptive characteristics. Incidentally it may be noted that it has a remarkably high sugar content as compared with the wild beets of southern Europe.
When experimentally cultivated the type proved completely constant and is apparently self-fertile in a much higher degree than most cultivated beets. On crossing with approximately pure lines of sugar beet a morphologically uniform F_1, in general intermediate, was obtained, shewing distinct heterosis in leaf size. It is probable that the North Sea ecotype is markedly homogeneous genetically and also in chemical composition. In the latter respect it resembles the sugar beet in contradistinction to the forage beet and Mediterranean wild forms.
The centre of evolution and of distribution of the genus probably lies in the eastern part of the Mediterranean where a gene accumulation, which accounts for the pronounced diversity of the Mediterranean wild beets of to-day, may be supposed to have existed. Migration of wild beets then probably took place to the west, south and north, accompanied by a diminution of material and the ecotype in question was the only combination of the original gene material to survive in the North Sea region.

665. MUNERATI, O. and MILAN, A. 633.41:633.63–1.547.25
Possibilità di svelare la presenza di bietole foraggere e semi-zuccherine tra le bietole zuccherine all'inizio della vegetazione. (**The possibility of revealing the presence of forage beets and semi-sugar beets among sugar beets at the beginning of vegetative development.**)
Ann. Sper. Agr. Roma 1930 : **3** : 137–39.
A brief description is given of the characters by which the different types can be distinguished while still in the seedling stage. When the plants are grown under continuous light the time before which a decision can be reached is considerably shortened.

666. PEARSON, O. H. 633.42:581.162
Study of the life history of *Brassica oleracea*
Bot. Gaz. 1933 : **94** : 534–50.
Floral development, pollination, and the ontogeny of the microspore, ovule and megagametophyte are described for cauliflower, broccoli, cabbage and sprouting broccoli. Insects are the pollinating agents. Embryogeny and seed development were studied in detail, the former with a view to determining the times at which the stages, described by previous workers on the *Cruciferae*, occur. Both pollen growth and longevity in relation to temperature were investigated. The haploid number of chromosomes is 9.

667. TEDIN, O. 633.42–2.411.1–1.521.6:575.11.061
Nedärvningen av resistens mot klumprotsjuka (*Plasmodiophora brassicae*) hos rova (*Brassica rapa v. rapifera*) i förhållande till vissa morfologiska rotkaraktärer. (**The inheritance of resistance to club root disease (*Plasmodiophora brassicae*) of turnips (*Brassica rapa v. rapifera*) in relation to certain morphological characters of the root.**)
Nord. JordbrForskn. 1932 : **14** : 324–31.
A resistant Danish variety, Marienlyst V with a short flat root, a length-breadth index lower than 1, and white flesh and green or light red upper part was crossed with two susceptible Swedish strains, Weibulls Pedigree Bortfelder, a well-known trade variety and Weibulls Rodtoppiga Bortfelder which is not yet on the market. Both these have very long roots and yellow flesh. The upper part of the root of the first is yellow or greenish yellow, that of the latter a deep red. There was a clear monofactorial segregation for white and yellow flesh colour, but there was no correlation between flesh colour and disease resistance.
No definite analysis of the red colour was possible but at least two factors are present and no definite correlation could be established with these factors and resistance.
Root shape is determined by multiple factors, and a larger number of short roots were found among the resistant roots, this may be a pleiotropic effect or more probably due to linkage of some of the factors for resistance with the factor determining shape.

No correlation was found between shape and dry matter content, which proves that there must be resistance factors (connected with shape) which are independent of the dry-matter content ; though this does not prove that dry matter content may not influence resistance.
The results shew that to combine the high yield of the Bortfelder type with resistance, the medium long roots of Dale's hybrid or Ostersundom might be profitably investigated.

668. SEMSROTH, H. 633.491:575.19
Die Abstammung der Kartoffelsorten mit früher Reifezeit. Ein Beitrag zur Züchtung. (**Pedigrees of early potatoes. A contribution on breeding.**)
Pflanzenbau 1932 : **9** : 28-37.

The breeding of a new, sound early-maturing potato is complicated by the fact that many of the early varieties do not set seed. The problem might, however, be solved by the crossing on a large scale of early varieties with pedigrees that include the most important lines. Other varieties of unknown pedigree would of course be used too in order to obtain the desired combinations.
Six pedigree lines are suggested, namely Early Rose, Joseph Rigault, Goodrich, Early Sunrise, Industrie and Zwickauer Frühe. Of the 39 early varieties 23 are of known pedigree and no less than 10 of these are descended from Joseph Rigault ; 6 are descended from Early Rose and 3 from Goodrich.
Out of 89 medium early varieties 71 are of known pedigree, 55 of these being descended from the 6 main lines mentioned. Early Rose is the line of most importance among the medium earlies. The characteristics of the 6 main lines are described in detail, their various progeny and their degree of resistance to wart disease mentioned. A number of miscellaneous varieties are also briefly discussed. Among the most successful crosses are included (1) Early Rose x Patersons Victoria which yielded 2 medium late varieties, Imperator and Magnum Bonum, both of which have produced a particularly large number of medium early progeny ; and (2) Early Sunrise crossed by Erste von Fromsdorf and Wilhelm Korn has yielded many medium early types.
Useful tables are given shewing the breeder's name, type of flesh, resistance to wart and original cross for the chief lines mentioned.

669. COSTANTIN. 633.491:575.252
Nouvelle variété montagnarde de pomme de terre issue de " La Violette," obtenue par M. Bouget dans les Pyrénées en 1922. (**A new mountain variety of potato of the " La Violette " strain found by M. Bouget in the Pyrenees.**)
C.R. Acad. Agric. Fr. 1933 : **19** : 592-96.

The ancestral and the new variety are described. The latter which probably arose as a bud mutation among the progenies of " La Violette " has remained permanent for 10 years and gave 300 kg. on 18 ares.

670. LIVERMORE, J. R. 633.491:575.252
Bud selection.
Amer. Pot. J. 1933 : **10** : 17-22.

The evidence for and against bud selection in the potato and other plants must be weighed and allowance made for the faulty methods of previous workers. In the author's opinion clonal selection should be tested as an aid in the improvement of strains of seed potatoes.

633.491:576.356
671. MEURMAN, O. and RANCKEN, G. 633.491:576.312.32
Untersuchungen über die Chromosomenverhältnisse bei kultivierten Kartoffelsorten (*Solanum tuberosum* L.). [**Studies on the chromosome behaviour of cultivated potato varieties** (*Solanum tuberosum* L).]
Soc. Sci. Fenn. Commentationes Biol. III, 20 : 1932 : 28 pp.

Root tip counts were made of 12 commercial varieties. All varieties possessed 48 chromosomes, including one pair of chromosomes bearing satellites but never more. This suggests

that one of the parental species of the cultivated potato was possessed of satellites and the other without and supports the view that *S. tuberosum* is an alloploid species.
The percentage of normal tetrads formed at pollen development varied in the different varieties from below 10 to over 90. Observations on the maturation division are reported, from which it is seen that the number of univalents was substantially the same in all varieties, seldom exceeding 8—10 and the number of chromosomes lagging or excluded from the nucleus was relatively small.
In metaphase I plates of all varieties the occurrence of a number of multiple groups of 2 and sometimes 3 bivalents was observed and some of these at least were apparently to be ascribed to secondary pairing. Primary pairing also seemed to occur and these facts thus shed little light on the question of allo- or auto-polyploidy.
The second maturation division was in the fertile group rather regular, the same secondary association of the chromosomes however being still observed. Many of the pollen mother cells of the abnormal groups however contained the unreduced chromosome number, the proportion of these rising to nearly 100 per cent in the varieties which exhibited the highest degree of sterility and leading to corresponding proportions of dyads. In such groups the second reduction division can be, and has by some writers been mistaken for metaphase I. Fusion of the two spindles is the commonest cause of duplication. However the sterility of these dyads remains yet unexplained.
The occurrence of hexaploid associations in metaphase I possibly may suggest that these plants represent a higher polyploid derived from a basic number of 6 although no octoploid associations have been observed. Moreover pentavalent groups are also observed and are ascribed to non-homologous interchange, which would also account for the occurrence of univalents in metaphase I.

672. Bukasov, S. 633.491-2.111-1.521.6
(**Frost resistance in the potato.**)
Bull. Appl. Bot. Leningrad 1932 : Ser. 2 (3) : 287-97.
In a very keen frost of below -5°C. all potatoes perished completely, with the exception of certain wild species, viz. *Solanum acaule* Bitt. var. *subexinterruptum* Bitt. from Peru, all varieties of *S. demissum* Lindl., *S. semidemissum* Juz., *S. edinense* Berth., certain hybrids of *S. demissum* with the South American cultivated species *S. andigenum* Juz. et Buk., and of *S. goniocalyx* Juz. et Buk. with *S. Bukasovii* Juz. ; the hybrid Caliban from *S. demissum* x Majestic and certain cultivated Peruvian and Bolivian forms of *S. Juzepczukii* Buk., *S. ajanhuiri* Juz. et Buk., *S. curtilobum* Juz. et Buk. and *S. andigenum* Juz. et Buk. f. *Pacus* Lechnovicz.
The occurrence of frost resistance in so many different species from such widely separated areas shews it to be a not uncommon character, not only in wild but in some cultivated species.
Species otherwise susceptible may display isolated immune forms, e.g. *S. andigenum*, *S. Commersonii*.
All these immune forms, with one exception, were found in the high mountains, and all but two hybrid forms were characterized by the rosette-like habit of growth.
S. acaule, in which this rosette habit was most pronounced was not mortally injured by -10°C.
S. acaule and *S. demissum* gave abundant fruits, the others less. Marked segregation occurred in very few of the wild species ; the chromosome number of some of the segregates from *S. Juzepczukii* was determined as 54 but this requires confirmation.
The hybrid Caliban apparently outyields the native cultivated species and there are indications in many crosses with *S. demissum* that resistance is inherited in interspecific crosses ; reference is made to neglected work of Klotzsch on these lines with *S. utile*.
Other rosette species, viz. *S. aracc-papa* and *S. Bukasovii* are also of interest and hybrids of the latter, which crosses especially easily with other species, have displayed immunity.
Owing to the earliness of *S. acaule* and *S. demissum*, seeds are obtained and sown, and produce tubers in the same year. The production of " flowering tubers " (see " Plant Breeding Abstracts " Vol. III, Abst. 451) may still further accelerate breeding operations. Reference is made to interspecific hybrids produced by Nesterovich, amongst which *S. acaule* x *S. aracc-papa* showed dominance of all characters of the former and was frost-immune.
These conclusions are supported by observations continued the following year.

673. MÜLLER, K. O. 633.491-2.411.4:576.16
Bemerkungen zur Frage der "biologischen Spezialisierung" von *Phytophthora infestans*. (**Remarks on the question of the biological specialization of *Phytophthora infestans*.**)
Angew. Bot. 1933 : **15** : 84-96.

The strain of the fungus from Streckenthin (see "Plant Breeding Abstracts," Vol. III, Abst. 236) capable of attacking the hitherto resistant W races, is evidently distinct from all the rest and is referred to as the S strain.
The W races have recently been shewn to consist of at least 3 types, whose tubers are susceptible, medium and highly resistant to the ordinary A strain, but these all proved equally susceptible to the S strain ; even the *Solanum demissum* x *S. tuberosum* hybrids tested have all proved susceptible.
The author justifies the position taken by himself and Salaman, shewing by appropriate citations that the possibility of physiological forms was not excluded by them but that their existence was regarded as insufficiently proved.
The author also disagrees with Schick with regard to the occurrence of resistant forms of potato, several of which, he says, have been found in material from South America in addition to the Mexican ones. The suggested origin of the W races from *S. demissum* x *S. tuberosum* is also shewn to be improbable.
In spite of the new form, confidence in the capacity of the W races to provide material resistant to *Phytophthora* is expressed.

FIBRES 633.5

674. MENÉNDEZ RODRÍGUEZ, J. 633.51:575(67.5)
El cultivo del algodón en el Congo Belga y la Estación de selección de Bambesa. (**The cultivation of cotton in the Belgian Congo and the Bambesa Breeding Station.**)
Agricultura, Madrid 1933 : **5** : 96-99.

Stations have been established for selection in each cotton area, with secondary stations for multiplication of seed. Of the former, Bambesa is the one of the northern region. The object is to combat the disastrous fall in productivity and quality which has come about in recent years.
The methods of mass and pure line selection employed are briefly outlined, with indications of the very considerable improvement effected and points to be borne in mind on judging the quality of the fibre.

675. CHEVALIER, A. 633.51:576.16
Le *Gossypium anomalum* Wawra et Peyr. est-il un cotonnier ou un *Cienfuegosia* ? (**Is *Gossypium anomalum* Wawra et Peyr. a cotton or a *Cienfuegosia*?**)
Rev. Bot. Appl. Agric. Trop. 1933 : **13** : 190-95.

From a comparison of the morphological characteristics of *Gossypium anomalum* Wawra et Peyr. and of *Cienfuegosia digitata*, the type of the genus *Cienfuegosia*, the author concludes that *Gossypium anomalum* Wawra et Peyr. (which later was classed as a *Cienfuegosia* by Gürke) should be regarded as a *Gossypium*. The geographical distribution of *G. anomalum* in Central and West Africa is discussed and certain morphological considerations are mentioned as evidence for the possibility that *G. anomalum* may perhaps have been the species from which certain cultivated cottons of the Old World have developed.

676. LONGLEY, A. E. 633.51:576.312.35
Chromosomes in *Gossypium* and related genera.
J. Agric. Res. 1933 : **46** : 217-27.

The author presents a study of the pollen mother cells of a number of species of *Gossypium*. With his own determinations are incorporated the observations of previous workers.
Recent studies shew the existence of two distinct groups, the Asiatic group in which the chromosome number is 13 (haploid), and the American group in which the number is 26. The results

are summarized and additional evidence, which is with one exception confirmatory, briefly noted. This exception refers to *G. sturti* the chromosome number of which was determined by Harland as 26 but of which the writer's determination is 13. In greater detail is given the observation of pollen mother tissue of a single Asiatic x American F_1 plant which, like those of other workers, produced sterile pollen.

Of plants of related genera, *Thurberia thespesioides*, *Shantzia garckeana* and *Sidalcea neomexicana* have 13 chromosomes ; the first-division metaphase of *Cienfuegosia heterophylla* shows 10 bivalent chromosomes ; *Hebiscus militaris* and *H. palustris* have 19 (possibly 20).

After a few notes on pollen sterility the author concludes that the five species *G. Stocki*, *G. sturti*, *G. harknessi* and *Thurberia thespesioides*, which all have 13 chromosomes and occupy isolated localities, may represent primitive stocks. The double chromosome number suggests duplications but this has not been demonstrated.

677. Cook, O. F. 633.51:677.21
Cotton fiber improvement necessitates community action to keep seed pure.
Yearb. U.S. Dept. Agric. 1932 : 145-48.

The author emphasizes the necessity of preventing insect pollination between the different varieties of cotton grown in proximity, resulting in impurity of seed. Uniformity of fibre is of primary importance to industry and must hence be the aim of breeding work. This uniformity is attained if the seed stocks of the varieties are isolated. Therefore any body undertaking to produce uniform cotton should restrict itself to one variety.

678. Uchikawa, I. 633.584.5:576.312.35
(Karyological studies in Japanese bamboo I. The chromosome numbers of several species.)
Mem. Coll. Agric. Kyoto Imp. Univ. 1933 : No. 25 : (Genet. Ser. No. 1.) : 11-20.

The paper records observations drawn from the pollen mother cells and root tips of 10 species or varieties of bamboo including *Phyllostachys reticulata*, *P. edulis*, *P. nigra*, *Sinobambusa tootsik*, *Chimonobambusa marmorea* and *Pleioblastus Simonii*. In all the cases the chromosome number was shewn to be n = 24 and 2n = 48. The nuclear phenomena of the first and second meiotic divisions were normal. Preliminary observations of other species indicate that this number is not invariable for all bamboos.

SUGAR PLANTS 633.6

679. Perez, S. L. 633.61
A study of *Saccharum spontaneum* Linn. subsp. *indicum* Hack. from the plant breeding standpoint.
Thesis No. 344. Expt. Sta. Contr. 1930 : No. 859 Philipp. Agric 1933 : **21** : 639-40.

This thesis presented for graduation describes a comparative study of two forms of *talahib* (*S. spontaneum*), called respectively ' large ' and ' small.' Corresponding observations were made on the canes CAC. 87 and S. 1861. Among the characters studied are age of flowering, time of opening of the flowers, number of stalks per stool, germination of points, percentage of germination of pollen grains and number of fertile pollen grains per anther.

680. Menéndez Ramos, R. 633.61(72.91)
Experiences with cane varieties in the island of Cuba.
Bull. 4th Cong. Int. Soc. Sug. Cane Techn. 1932 : No. 68 : 23 pp.

English version of paper referred to in " Plant Breeding Abstracts " Vol. III, Abst. 95.

681. Posthumus, O. 633.61:575
Joh. M. Versteegh.
Arch. Suikerind. Ned.-Ind. 1930 : No. 43 : 984, 985-89.

An appreciation of the work of the late J. M. Versteegh and his contribution to the Java sugar industry in the production of the famous EK series of canes. EK 28 was in its time an excellent cane and has given rise to the majority of the best POJ canes.

The writer deprecates the little reward that Versteegh, in company with other breeders in similar circumstances, reaped for his pains.

682. RICHARDSON KUNTZ, P. 633.61:575(72.95)
The production and experimental testing of new varieties of sugar-cane in Porto Rico.
Bull. 4th Cong. Int. Soc. Sug. Cane Techn. 1932 : No. 41 : 12 pp.
English version of paper referred to in " Plant Breeding Abstracts " Vol. III, Abst. 97.

683. CROSS, W. E. 633.61:575(82)
Las cañas " tucumanas " de semillero. Informe de los ensayos de los años 1927-1931. (" **Tucuman " seedling canes. Report on tests of 1927-1931.**)
Rev. Ind. Agric. Tucuman 1932 : **22** : 169-205.
The yields and sugar content of the canes produced and selected at the Tucuman station in the various years from 1917 to 1931 are tabulated and the qualities of individual numbers described. Many were superior to the standard (P.O.J.36) in yield, but most were inferior in sugar content. Tucuman 472 constituted to a certain extent an exception and approached the standard in kilogrammes of sugar produced per hectare.

684. JESWIET, J. 633.61:575.12:608.3
Protection du droit de propriété des hybrides nouveaux de *Saccharum officinarum* L. (la canne à sucre). **Protection of the property right of new hybrids of *Saccharum officinarum* L. (sugar cane).**)
XV Cong. Int. Agric. Prague 1931 : Sect IV (a) : 1-5.
See " Plant Breeding Abstracts " Vol. II, Abst. 469.

685. CREAG, G. Y. 633.61:575.127.2
A study of cross-compatibility between talahib (*Saccharum spontaneum* Linn. Subsp. *indicum* Hack.) and other species of *Saccharum*.
Thesis No. 341. Expt. Sta. Contr. No. 877. Philipp. Agric. 1933 : **21** : 717-18.
In this abstract of a thesis presented for graduation an account is given of attempts made to cross talahib with a number of canes. A list is given of cross-compatibility as indicated by a number of seedling characters.

686. VENKATRAMAN, T. S. and THOMAS, R. 633.61:575.127.5:633.174
Brief note on sugar-cane-sorghum hybrids.
Bull. 4th Cong. Int. Soc. Sug. Cane Techn. 1932 : No. 67 : Pp. 8.
With a view to obtaining short duration sugar canes for the sub-tropical regions of northern India, the authors attempted to cross cane with various short duration cereals including *Oryza sativa*, *Sorghum Durra* and *Pennisetum typhoideum*. Attempts were also made with weeds such as *Cyperus rotundus*. Co. 2725 was originally chosen as mother parent as it possesses little pollen and sets seed freely when crossed. Undoubted hybrids were only obtained with *Sorghum*. In 1931 the choice of parental types used on both sides was largely extended.
The hybrid seedlings, of which many thousands were obtained, were distinguished by their shorter and broader leaves, a number (up to 8 per cent) of albinos and a high mortality due to poor root development. The hybrid plants shewed a marked decrease of vigour and early cane formation rarely occurred. The hybrids shewed considerable variability *inter se* and the main characters were observed and abnormalities were frequent both in the vegetative organs and inflorescence.
From the economic standpoint it is noted that the number of uneconomic types is very high ; they may be readily propagated by sets and they are characteristically early maturing. Six of the seven selected from 7,000 germinated matured in seven months with fair tonnage and juice with sucrose ranging from 15·79 to 12·35 per cent, glucose from 1·75 to 0·26 per cent and coefficient of purity from 86·9 to 79·2.

687. FAWCETT, G. L. 633.61:575.252
Descripciones de variedades de caña, I. La variedad P.O.J. 36 y sus mutaciones. (**Descriptions of cane varieties, I. The variety P.O.J. 36 and its mutations.**)
Rev. Ind. Agric. Tucuman 1932 : **22** : 206-12.
Following upon a description of the mother cane in some detail are given descriptions of three mutant canes found in the local material, the purple and the striped and the Japanese M type, a variant of the latter.
The purple cane differs from the original not only in colour but in being more vigorous and in certain minor details.
The striped mutant produces a lower quantity of cane than the common form, but has a higher sugar content. It regularly produces 2 or 3 per cent of normal mutants.
The M type is faintly striped and regularly produces both ordinary striped and common (white) mutants. It is also slightly inferior in yield and superior in sugar content.

688. BREGGER, T. 633.61:575.42
Some notes on selection of cane seedlings in the early stages of the first year.
Bull. 4th Cong. Int. Soc. Sug. Cane Techn. 1932 : No. 40 : Pp.3.
The paper describes the method of early selection in the seedlimgs raised at the Insular Experiment Station, Porto Rico. The basis of this is that *all* seedlings are carried on to the field, the smaller ones being carefully nursed by potting. By dividing the seedlings into large and small and following out their subsequent development till the first field selection, it was found that it was an even chance whether the selected seedlings came from the small or the large group. Vigour in the early seedling stage is, therefore, an unreliable guide to the ultimate value of a seedling.

689. NORTH, D. S. 633.61–2.3–1.521.6:575
Obtaining resistant cane varieties for the control of gumming disease.
Bull. 4th. Cong. Int. Soc. Sug. Cane Techn. 1932 : No. 30 : Pp. 3.
In 1893 gumming disease appeared in epidemic form and was controlled to extinction by 1912-15 through the replacement of the susceptible Rappoe by resistant canes. These, in their turn, were replaced by higher yielding varieties such as Badila which, though susceptible to gumming, remained free from 8 to 15 years. The second epidemic of the disease commenced in 1920. This has led to a demand for a variety which is definitely resistant to the disease.
The author describes the system of chequer plots, with a fringe to windward of a susceptible variety of which one shoot in each stool is inoculated. Reliable results are now obtained with a plot of one row containing four stools. A numerical system of measuring the intensity of infcteion has been worked out and the varieties are classed as A. Resistant, B. Doubtful and C. Susceptible. A continuation of observation to include ratoons added no further information and only plant canes are now examined.
Originally varieties were included in the 3rd or 4th year, but difficulty arose in obtaining disease free canes when seedlings were tested as single stools. By treatment of the cane with water at 50°—51° for 2 hours, cuttings are disease free.
Seedlings are raised from fuzz imported from the tropics. Prior to 1928 most of the seedlings were derived from susceptible parents ; since that date a number of promising seedling lines have been obtained. In those of 1928 a marked correlation appears to exist between vigour and resistance. Promising lines include POJ2364 x China (a *S. sinense* type), and a statement is given of the various resistant canes which are being introduced into the parentage. Generally speaking less than 10 per cent of pure *S. officinarum* types are sufficiently resistant but a much higher proportion of resistant types occur among seedlings partly derived from *S. spontaneum*, *S. Barberi* or *S. sinense*.

690. Richardson Kuntz, P. 633.61–2.8
Resistencia relativa al matizado de cañas producidas en el pais comparadas con las importadas. (**The relative resistance to mosaic of sugar canes produced in the country as compared with imported canes.**)
Circ. P. Rico (Ins.) Agric. Expt. Sta. 1932 : **101** : Pp. 23.
The disadvantages of importing canes from other countries are indicated. Descriptions are given of a test including all the locally grown varieties and various new varieties of promise, either imported or bred on the island. The canes are then arranged according to merit, taking into account their susceptibility and commercial value. The canes PR–803, FC–916 and PR–807 proved definitely superior to the BH–10 (12) used as control. The imported cane POJ2878 also proved superior.

691. Dahlberg, H. W. 633.63:575
The breeding of sugar beets. A progress report on work by the Great Western Sugar Company. Chemical study as an aid in beet breeding.
Facts ab. Sug. 1933 : **28** : 136–37.
In investigating the possibility of developing sugar beet strains suited to Colorado soil and climate, selection was made for low nitrate and low chloride content, two characteristics which had previously been found to be correlated with poor quality and with low sugar content respectively. Two commercial strains were compared with a semi-stock beet (a " half sugar " strain) and a wild beet strain. From these and other results it is clear (1) that wide variations in chemical composition (e.g. sugar content and the ratio of calcium and magnesium to the total ash) exist even in apparently good breeding stock and (2) that families differ consistently in such characters. Incidentally it is stated that different strains vary in sugar loss by respiration in silos during the winter and that therefore the sugar content tests should be made in autumn and not in spring, as is customary in Europe.
The author suggests that the chemical method of investigation may possibly prove applicable to the problem of disease resistance too.

692. Stewart, G. 633.63:575.14
Some effects of inbreeding in sugar beets.
J. Amer. Soc. Agron. 1933 : **25** : 237–58.
The results obtained in Utah since 1925 by inbreeding sugar beet strains from an already inbred variety, Janascz, are recorded. The methods used and the variability of various strains are described. Among the characters observed were : leaf types, seed size and sugar content. Certain abnormalities of leaves and stalk are recorded but exact genetic investigation was impossible. The occurrence of segregation and increased uniformity due to inbreeding represents the main genetic finding. The effect of light during the vegetative stage is briefly touched upon.

693. Colin, H. and Bougy, E. 633.63:581.192:575.12
Structure et richesse saccharine dans les hybrides de betteraves. (**Structure and sugar content in hybrids of beetroot.**)
C.R. Acad. Sci. Paris 1932 : **194** : 1680-82.
A cross was made between forage and sugar beets. The sugar content was 11 per cent, intermediate between that of the two parents (7·5 and 13 per cent respectively) and the root structure resembled that of the sugar beet.
In the second generation sugar contents ranged from 4 to 15 per cent, the richest being on the whole fibrous as the sugar beet, the poorest having less strongly developed vascular tissue as in the forage beet. Certain exceptional plants however had high content and low vascular content and vice versa.
Sugar content in the F_3 varied from below 7 to 13·3 per cent. The latter was a woody plant, but the second richest, with 12·6 per cent, was of the non-woody type.
The F_4 was still far from homozygous ; 15 plants with 14-15 per cent sugar were obtained, of which 2 were non-woody.
It would seem possible thus somewhat to improve the form of the sugar beet without loss in sugar content.

694. Coons, G. H. 633.63–2–1.521.6:575
Sugar-beet production is entering new era as disease control gains.
Yearb. U.S. Dept. Agric. 1932 : 362–64.
A brief description is given of the diseases to which sugar beets are susceptible. Leaf spot resistant and curly top resistant strains of sugar beets have been produced as a result of breeding work. These strains are also of high quality and high yielding capacity.

STIMULANTS 633.7

695. Díaz, A. M. 633.71:575(46)
Aclimatación seleccion y mejora de la variedad " Valencia." (**Acclimatization, selection and improvement of the variety " Valencia."**)
Agricultura, Madrid 1933 : **5** : 73–76.
The process of acclimatization of tobacco invariably consists in selecting, from a number of variants originating from occasional out-pollination, those best adapted to the new conditions. Extreme variants obtained by repeated selection from such a mixed population are illustrated and described, one of which being 0·90 and the other 1·20 m. high.
The method of self-fertilization is described. In three generations homozygous plants are said to have been obtained. These will later be crossed with tobaccos of other types.

696. Schiriaev, A. I. and Semenov, F. K. 633.71:575(47)
[Yellow tobacco variety tests in Kuban district (Goriatchi Klutch) 1929-1933 and on the Black Sea Coast (Sotchi).]
Bull. Inst. Tobacco Ind. U.S.S.R. Krasnodar 1932 : No. 85 : Pp. 59.
The tobacco formerly grown was a mixture of forms of very different type and quality and one of the main functions of research is to " accelerate breeding work " so as to enable pure lines to be introduced, each selected for a particular region and resistant to the prevalent diseases. At the same time observations are being made on introductions of various well-known varieties or their hybrids or interspecific hybrids.
In 1931 the whole of North Caucasia was supplied with selected seed and the harvest of 1932 affords a three years' supply of selected seed, fully guaranteeing the tobacco production in the second Five Year Plan.
The climatic, soil and agricultural conditions of the region are described. Selection has progressed so far that to-day in spite of the extreme variety of conditions existing in the region, only two sorts, represented by three races, are grown.
In the large leaved varieties, the Trapezond type, with close habit, resistance to unfavourable conditions and diseases, higher yield and equally satisfactory quality, is being preferred to the Kuban types. Quality has also been an important consideration in making selections.
The total number of leaves per plant was the least variable character, leaf width or plant height the most variable. Little correlation was observed between time of flowering and time of maturity except in extreme types.
Detailed descriptions of the variety tests are given.

697. Kostoff, D. and Popoff, I. 633.71:575.1:581.192.7
Inheritance of nicotine.
Biol. Generalis, Vienna 1931 : 7 : 283–86.
Various interspecific crosses were examined. The nicotine content of the F_1's was lower than the average between the two parents, e.g. *N. sylvestris* (1·458 per cent) x *N. Rusbyi* (1·652 per cent) F_1 had 1·19 per cent, while the F_1 of *N. glauca* (2·59 per cent) x *N. Langsdorfii* (0·875 per cent) had 1·037 per cent.
Great variation occurred in F_2, some plants having a nicotine content below that of the F_1 plants.
Some plants from the triple hybrid *N. tabacum* x (*N. Rusbyi* x *N. tomentosa*) had a nicotine content equal to the highest parent (*Rusbyi*) and in the selfed progeny of the backcross (*N. tabacum* x *N. Rusbyi*) x *N. tabacum* plants appeared with higher nicotine than either parent. Multiple factors are clearly present.

698. KULIKOVA, E. 633.71:575.127.2:576.356.5
(A comparative study of triploid hybrids *Nicotiana tabacum* L. x *Nicotiana rustica* and their parental forms.)
Bull. V.I.M.P., Kiev, 1933 : 1 : 8–27.

From various backcrosses with *N. rustica* of the tetraploid hybrids produced by Eghiz from *N. tabacum* x *N. rustica*, a group of triploids was obtained. These were compared with the tetraploid and with the corresponding varieties of *N. rustica*, the results of which are here tabulated and discussed.

In the earlier growth stages the triploids were taller than the tetraploid but shorter than *N. rustica*, a certain variation being evident between triploids of different parentage. Later the triploids surpassed the *rustica* varieties and by the time of flowering the tetraploid had also surpassed *rustica* and begun to approach the triploids in size. During development the differences between the different triploids became less and less marked ; the largest was the one from the largest *rustica* parent, but in the other cases no influence of the height of the *rustica* parent was detectable. The tetraploid was latest of all to mature, followed by the triploids, which again were very little influenced by the time of ripening of the respective *rustica* parents, although the earliest of them was from the earliest *rustica*.

The triploids had the maximum number of leaves, again varying little according to parentage ; similarly in leaf length and area and fresh weight per plant. The diameter of the base of stem was greater in the triploids than in the tetraploid and the *rustica* parents ; some of the latter exceeded the tetraploid, others not ; their influence on the triploids was slightly more evident. The diameter of the central portion of the stem resembled that of *N. rustica*, the tetraploid being much smaller.

The attack by phytomonas was greatest in the triploids from the most susceptible *rustica* parent. The yield per plant was slightly higher in the triploids but their yield was very uniform, therefore the yield increase was not great in those cases where the *rustica* parent yielded highly. Only the most extreme yield differences between the *rustica* parents were reflected in the triploids. The maximum yield by this method is evidently to be obtained by taking such original parents as to give the greatest possible yield in the tetraploid.

699. MCCRAY, F. A. 633.71:575.127.2:581.162.5
Embryo development in *Nicotiana* species hybrids.
Genetics 1933 : 18 : 95–110.

The author sets himself the following questions : Does fertilization take place as readily in the hybrid as in the pure species ? Do the cell divisions in and consequent growth of the embryo proceed as rapidly in the hybrid as in the pure species ? If so, when does growth in the non-viable embryos stop ? If not, what sort of growth rate does the hybrid have as compared with its pure parent ? The material used to answer these questions was obtained from a number of species of *Nicotiana* and hybrids between them ; the method was fixation and sectioning of the capsules at two day intervals from 7 to 21 days subsequent to pollination. From the observations growth curves are plotted.

For the purpose of comparison four groups are recognized, (1) failure very soon after fertilization, (2) failure to complete embryonic growth, (3) partial germination but followed by failure to mature and (4) successful maturation. In the case of groups (3) and (4) the curve for the hybrid embryo simulated that of the maternal parent, but always fell somewhat below it. The cause of the failure was not studied, but the comparative discussion is based on the earlier observations of Kostoff and Brieger.

700. POPOFF, I., KOSTOFF, D. and KENDALL, J. 633.71:575.243:581.192.7
(Nicotine content in an experimentally obtained tobacco population.)
Zemled. Misal, Sofia 1930 : 1 (2) : 71–74.

Various operations on the anthers of *Nicotiana tabacum* before and during meiosis resulted in the formation of 25—85 per cent abortive pollen. About 800 plants obtained by selfing with such pollen differed widely from the original type in morphological characters and growth rate. On testing the most marked variants the percentage nicotine content during the flowering period was found to range from 0·454 mg. to 1·944 mg. ; whilst as compared with the various mother plants ratios of approximately twice and one half the nicotine content were found in the progeny.

701. KOSTOFF, D. and KENDALL, J. 633.71:575.31:575.243
Variants and aberrants of *Nicotiana tabacum* obtained experimentally.
Biol. Generalis, Vienna 1931 : **7** : 271–82.

By puncturing the buds with needles shortly before or during meiosis various meiotic irregularities were induced in the pollen mother cells, including pentads and higher numbers, and certain cases of chromosome duplication due to failure of cell division after chromosome division ; dyads and monads resulted in this way.

A certain amount of progeny was obtained from selfing such flowers and contained many aberrant plants with respect to time of flowering and morphology.

Some of the aberrants were cytologically quite normal, in others various meiotic irregularities were observed. Plants with abnormal chromosome number also occurred, e.g. plants with 28 ±, others with 25±, and one with 24 in metaphase I, but 25 or 26 in the later stages, possibly resulting from tri- and tetravalents which later separated. The meiotic behaviour of a number of these plants is described.

Since only the anthers were affected in the original plant, these abnormalities, both chromosomal and physiological, have evidently been transmitted entirely by the pollen.

Varying percentages of abortive pollen were observed in the aberrant plants, the number of seeds set by selfing varying proportionally to the pollen viability.

Progeny tests are being made to test the permanency of the variant types.

702. 633.71:576.312.35
TANAKA, H. 633.71:575.127.2
(The genetics and cytology of some varieties and hybrids of Japanese tobacco. I.)
Jap. J. Genet. 1933 : **8** : 85–96.

The haploid number in a series of *N. tabacum* varieties cultivated in Japan proved to be 24, except in one variety " Okusa-ha," in which, in addition to normal cells with 24, other cells with 30, 36, 42, 48, etc. chromosomes occurred. Goodspeed's findings in *N. glauca* were confirmed, n being equal to 12. The F_1 from *N. tabacum* var. *petiolata*, " Ibusuki-ha " (n=24) x *N. glauca* (n=12) was self-sterile. A few non-viable seeds were obtained on pollinating with *N. glauca*, but none from the reciprocal cross.

703. KOSTOFF, D. 633.71:576.356:632.8
Virus diseases causing sterility.
Phytopath. Z. 1933 : **5** : 593–602.

In some tobacco plants including pure species and species hybrids there occurred individuals of somewhat peculiar appearance with definite abnormalities of reproductive organs, completely ♀ sterile on selfing and with pollen from normal plants. The pollen in the affected plants was functional and on normal ♀'s produced good seeds and normal plants. Such pollen, however, failed to function at low temperature or with insufficient light.

Owing to the mode of occurrence of the abnormal flowers, virus disease was suspected as the cause; and the transmission of symptoms was tested by different kinds of grafts, with various types of *Nicotiana*, *Solanum Lycopersicum* and species of *Datura*. In many instances the affected scion caused the production of sterile flowers in the plants receiving the graft. It was also found that normal *N. glauca* could be infected by grafting and though shewing no symptoms itself can re-transmit the agent producing ♀ sterility to normal plants.

The symptoms are assumed to be due to a so-called " female sterility virus." Various other cases of virus disease producing sterility, as in plums, or partial sterility, as in mosaic diseases of *Nicotiana* varieties, are mentioned ; and it is suggested that Stow's work on male sterility in potatoes, and Bleier's study of irregular meiosis in potatoes and its relation to temperature are all perhaps capable of interpretation on the assumption of some virus reaction.

In severe mosaic manifestations meiotic abnormalities and increased chromosome numbers result, and heteroploids and polyploids might thus be formed. The author touches on the possibility that virus effects might conceivably act as the primary or a subsidiary agent in conditioning mutation processes. The relationship between abnormal reduction division and mosaic in tobacco is believed to be based upon abnormal metabolic reactions, due to the virus.

704. East, E. M. 633.71:576.356.5:576.357
The behaviour of a triploid in *Nicotiana Tabacum*.
Amer. J. Bot. 1933 : **20** : 269–89.

The paper commences with a review of the cytological observations on triploids since triploidy was first discovered by Gates in *Oenothera* (1908). This evidence, combined with a few pedigree cultures, indicates a gene-by-gene association during the early stages of meiosis where such association is possible. East concludes this discussion with the suggestion that the mechanism for bringing complete genoms into gametes at meiosis and into daughter cells at mitosis is a more generalized and less obvious scheme than that usually visualized. There follows in this preliminary discussion a record of the observed chromosome numbers in the progenies of triploids. The new observations deal with a triploid which occurred in a culture of *N. tabacum purpurea*. It is the only variety of *N. tabacum* to yield triploids of which a second instance was recorded by Goodspeed as the result of X-ray treatment. The triploid exhibited some self-fertility but the observations here recorded refer particularly to a family of 30 plants from triploid x diploid. By determining the chromosomal number of these 30 plants and subtracting 24, the number of chromosomes in the functioning female gamete is determined. These numbers range from 26 to 35 but the several numbers occur in very different proportions. The curve appears bimodal with a mode at 30 (8 plants) and another at 33 (5 plants), and there is a marked deficiency of 29 (2) and 31 (1) chromosome plants. Further, there is a marked differential fertility between plants having the same number of chromosomes and it is probable, therefore, that the extra chromosomes of a gamete having a given number are not usually the same. There follows a detailed account of the progeny grouped according to their chromosome number.

Eighteen plants were raised from the triploid selfed ; of these, 9 were sterile, of which two produced no pollen mother cells. A differential fertility characterized the other nine. Brief notes are given of the counts on 11 of these plants.

The most interesting of the observations, however, refer to valency. The association of the chromosomes in the triploid was usualy such that 36 chromosome masses could be counted though counts up to 42 were recorded at first metaphase. Some of these could be interpreted as trivalents doubtfully. At first anaphase univalents occasionally occured, but no trivalents and the behaviour here was that to be expected of 36 bivalents.

In the light of this very unorthodox conclusion the paper terminates with a reference to the cases of supposed conjugation of non-homologous chromosomes and with a discussion of the basic number of chromosomes in *Nicotiana*. In this, mention is made of the types of pairing in certain inter-specific crosses within the genus.

705. Kolkunov, V. 633.71–1.525
[About the changes in the yellow tobacco variety " Platana-Arcadia " acclimatised in Central Black Earth (Chernozem) Region.]
Bull. V.I.M.P., Kiev, 1933 : **1** : 5–7.

" Original " seed was obtained and seed of the first and fourth generations from it were sown in comparison. Certain clear differences had resulted from four generations of acclimatization. The fourth generation plants began flowering later than the first generation, they took longer to reach full size. The leaves were darker green, consequent upon reduced cell size without reduction in chlorophyll ; the corolla was pink instead of white, probably a sign of a rise in sugar content and a useful character in selection. Actual measurements shewed the cells to be smaller in the fourth generation.

706. Wellensiek, S. J. 633.72:575.42:578.08
Kweekerij-selectie bij thee door beoordeeling op het oog. **(Nursery selection in tea by visual examination.)**
Arch. Theec. Ned.–Ind. 1932 : **6** : 123–32.

A batch of 500 trees of a uniform population about 2½ years old was divided into 5 lots, from each of which the best 10 and the next best 10 were chosen by eye by 6 independent observers. The weight of stem + leaves and of roots, the stem diameter and height were then determined for all plants and the plants were arranged in other groups according to these various determinations. The percentage figures for the correspondence between the two lots of judgments were obtained

by multiplying by 10 the number of trees in each group of 10 which were identically placed by the two methods of judging.

The agreement between the different observers was fairly close. For weight and stem diameter the two lots of judgments agreed in general by about 63 per cent when groups of 10 were compared. Comparing groups of 10 selected by eye with 20 selected by yield determination, the agreement was 88 per cent ; comparing groups of 20 the agreement was 76 per cent and 20 eye with 40 determined plants gave an agreement as high as 97 per cent. These are much closer agreements than would be expected by the laws of chance and it is pointed out that those plants which do not agree differ only inconsiderably, falling usually into the next nearest group. They thus afford a striking justification of eye selection. Plant height gave much less close agreement.

Correlations were calculated between the development of roots and that of superterrestrial organs. These were high, varying from +0·80 to +0·93. Bad root form, etc., was equally frequent in all groups and appeared to be connected with the nature of the ground.

The author attributes the favourable results partly to the small number of trees with which he dealt and partly to his having selected the best and not the worst as in certain other experiments on similar lines.

707. .. *Bakhtadze, K. .. 633.72:581.162.3

(Pollination of tea—*Camelia sinensis*—in Georgia.)

Subtropics 1932 : 4th year ed. No. 2 (12) : 64–80.

A study of the flowering of the tea plant at Chakva. From 1928 to 1930 varying numbers of plants were isolated. A reduction of 85—95 per cent in the set of fruits resulted from isolation. Nevertheless in most experiments a certain number of fruits, varying from 1 to 118, were produced. No increase in seed production resulted from artificially self-pollinating the isolated trees.

The seeds produced by self-pollination gave a percentage germination of only 34 as compared with 75 for cross-pollinated seeds, and the seedlings produced contained a greater number which failed to reach maturity. The plants produced were moreover reduced in vigour and size. Thus though self-pollination is by no means excluded, cross-fertilization is the rule. There is reason to believe that a certain amount of self-fertilization occurs under certain conditions in nature. Trees bearing flowers with short, long and medium length styles occurred. The former gave the greatest number of fruits, apparently on account of the shorter distance for the pollen tube to traverse.

Up to 500 pollen grains commonly attach themselves to the stigma. Germination occurs on the first day after pollination. Pollen germinated and penetrated normally in selfed plants, but much less rapidly and vigorously.

Pollen germinated readily in artificial media.

Bees are the chief pollinating agents, but there are not enough to effect complete pollination of all the flowers. Bees and wasps also fail to visit emasculated flowers.

708. Cramer, P. J. S. .. 633.73(59.7)

Coffea excelsa.

Rev. Bot. Appl. Agric. Trop. 1933 : 13 : 21–30.

An attempt was made to find a substitute for *Coffea arabica* cultivated so far in Indo-China, the yields produced by this species being very variable. It appears that *C. excelsa* gives regular and high yields, is resistant to diseases and more adaptable to soil and climate. Its disadvantages are its lower quality, the difficulty of its preparation for the market and the lateness with which it begins to yield.

Technical hints on cultivating *C. excelsa* are given.

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* A full summary of this paper is on file at the Bureau.

709. HALL, C. J. J. VAN 633.73:575.42(92.2)
La sélection du café Robusta à la plantation " Banaran." (**Selection of Robusta coffee on the " Banaran " estate.**)
6th Cong. Int. Agric. Trop. Subtrop. 1931 : **2** : 306–10.

Data are now available on 16 clones and 16 seedling families from selected mother trees. From 22 mother trees under observation with respect to yield, resistance to *Hemileia vastatrix* and quality, 6 have been eliminated, 2 on account of susceptibility and 2 for poor quality, leaving 16 in all.

The mean yields for 1927, 1928 and 1929 are tabulated. A close correlation is evident between the yields of the grafted and seedling progenies, also between that of the clones and mother trees. The correlation of the seedlings with the mother trees and clones was less pronounced. The best clones produced between 6·780 and 7·974 g. of fruits per tree in three consecutive years on a not particularly good soil.

Seedling progenies were less certain than those obtained by grafting on the trunk.

710. FERWERDA, F. P. 633.73:581.162
Bloei en bloeislaging bij koffie. (**Flowering and setting of flowers in coffee.**)
Bergcultures 1933 : **7** : 306–12.

The development and setting of flowers is largely influenced by meteorological conditions acting at three stages before, during and after the flowering period. During the period when cross-pollination and fertilization are taking place a mild wind is necessary with no rain (or mist) until after the pollen tube has penetrated the ovary ; and the author's investigation shewed that in the Robusta variety the period required for penetration of the ovary is from 12—24 hours, from which he concludes that rain before this 24 hours has elapsed would be injurious. Again after fertilization a dry period is required and it is estimated that a moderate rainfall about a week after blooming time provides the most favourable conditions for formation and growth of the berry.

The results of three years observations of the percentage of fruit set by a group of Bangelan varieties of coffee (mainly Robusta) are given; 24,000 flowers from 112 branches on 52 bushes were examined and it was found that during 1930 and 1931 only about 13½ per cent of the total number of flowers ultimately formed ripe berries. The various factors underlying failure to flower or set fruit are considered and their relative importance discussed; and as preventive measures against this form of loss, the provision of shade during the East monsoon season as a means of retarding flowering and temporarily reducing the water requirements of the plant is suggested. The subsequent flowering period would then coincide with the regular rainfall. The possibility of using late or early varieties according to the local conditions of rainfall, etc., and finally of breeding from clones and lines known to react less rapidly to rain than others should also be considered by planters.

711. HALL, C. J. J. VAN. 633.74:575.42(92+72·9)
La sélection du cacaoyer. (**Cacao selection.**)
6th Cong. Int. Agric. Trop. Subtrop. 1931 : **2** : 343–45.

Selection experiments in Trinidad and Java are pointed to as shewing the considerable improvement which can be brought about by selection, races from the two countries giving yields of 1·420 and 1·290 kg. of cacao per ha. being quoted.

The stages of selection are indicated, consisting of preliminary choice of mother trees on the basis of yield, quality and resistance, planting of isolated clones from which seeds are obtained, the latter giving seedlings. Observations are then made on both seedlings and clones.

Urgent questions for solution are the relative merits of seedlings and clones for plantation, and the influence of the stock on the scion.

Where Forastero x Criollo hybrids can be grown, enhanced quality by this means is more profitable than an increased yield.

The advantage of selective thinning is also emphasized.

712. Chmelař, F. and Šimon, J. 633.75(43.7)
Vývoj a výnosnost zušlechtěných odrůd máku v letech 1931 a 1931. **(Development and yield of improved poppy varieties in the years 1931 and 1932).**
Věst. (Bull.) Českoslov. Akad. Zeměd. 1933 : 9 : 123–27.
The cultivation of poppy in Czechoslovakia having lately markedly increased, the author studied six Czecho-slovakian and one German variety. Data on the time of flowering and ripening, on the morphology of the plants and on the yield, colour and fat content of the seeds are tabulated and the types described.

OIL PLANTS 633.8

713. Popova, G. M. 633.853.55
(Castor oil).
Lenin Acad. Agric. Sci., Inst. Appl. Bot. and New Cult., Leningrad 1930 : Pp. 63.
Starting with the history of its cultivation, which extends back to ancient India and Egypt, the authoress goes on to give a very brief account of the geographical distribution of the plant under cultivation and its probable origin. In India it probably grows wild and occurs everywhere accompanying man as a weed, which has probably been taken into cultivation and given rise to the cultivated forms.
Botanical descriptions of the plant are furnished, followed by remarks on the subspecies and sorts in cultivation, with illustrations. Thus *Ricinus communis* L. ssp. *persicus* G. Popova, ssp. *sanguineus* G. Popova, ssp. *zanzibarinus* G. Popova and the Chinese Early subspecies are described, including several selected sorts of the first of these subspecies.
In the remarks on breeding, increased yield and oil content are designated as the chief desiderata, and earliness with high yield as a desirable combination ; the fruits should dehisce, but not too much, and if possible types with spineless fruits should be produced. The desirability of cultivating only one sort is mentioned.

714. *Hiltebrandt, V. M. 633.853.74
(Sesame.)
Lenin Acad. Agric. Sci., Inst. Pl. Ind., Leningrad, 1931 : No. 41 : Pp. 79.
[Sesame (*Sesamum indicum* L.)]
Bull. Appl. Bot. Leningrad 1932 : Ser. 9 (2) : 3–114.
A new classification of the species is presented, based on the world collection of types involving 500 samples. The species is divided into two subspecies *Sesamum indicum* ssp. *bicarpellatum* and ssp. *quadricarpellatum* ; these are divided into varieties, of which 111 are indicated in a diagnostic key.
A study of the wealth of characters and of varieties in various countries shews India as the centre for the bicarpellate and Japan for the quadricarpellate subspecies, but since the related species of the genus are found only in South Africa, this is considered to be the real centre of origin, India and Japan being secondary centres. Related forms of *S. indicum*, characterized by dominant characters, are found in Abyssinia, whence they are supposed to have passed into India where conditions were so favourable as to lead to the development of a multitude of secondary forms. On spreading from here to the Far East, favourable conditions were again found in Japan, where an entirely distinct group of forms developed, with a predominantly recessive character.
Five geographical groups, each consisting of two distinct subgroups, exist, differing from one another in not one, but a whole series of characters, including quantitative characters.
The distribution of the various characters through the various groups is shewn. Only 15 characters were common to all countries. Endemic forms occur in many countries.

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* Full summaries of these papers are on file at the Bureau.

The forms of each country are very mixed, but represent distinct and characteristic ecotypes. The chief of these are described.
The forms with the maximum seed weight, oil content, etc., are found in and about Palestine, a gradual diminution being observed towards the east.
A rare group of extreme earliness occurs in Manchuria and another nearly as early in Turkmenia.
The countries containing early types are of especial interest in that they afford excellent material for breeding, earliness being one of the most desirable qualities. For yield increase the plants with many stems are the types most suitable, especially those with three flowers per axil.
Immunity to *Fusarium* is very desirable and only immune plants are used for breeding.
No correlations have been observed between oil content and a variety of other characters studied.
In breeding it is necessary to guard against out-pollination.

715. JOHNSON, I. J. 633.854.54:519.241.1
Correlation studies with strains of flax with particular reference to the quantity and quality of the oil.
J. Amer. Soc. Agron. 1932 : **24** : 537–44.

In 1929 and 1930 varietal differences in the percentage of oil and also in the iodine number of the oil and their relation to plant and seed characters in 46 strains of flax were studied by means of simple, partial and multiple correlations, Fisher's method of interpreting the correlation coefficients being used. The iodine number was studied only in 1930. The percentage of oil proved to be closely correlated with seed weight, time of ripening and the number of days from full bloom to maturity ; whereas the low multiple correlation of the iodine number of the oil with these same variables suggested that the iodine number is inherited independently of the plant and seed characters studied. Inter-annual correlations of oil content, seed weight, time of ripening and interval between full bloom and maturity indicate that these are constant hereditary characters.

716. OPSOMER, J.-E. 633.855.34(92.1)
Notes sur l'Elaeis à la Côte Est de Sumatra. (**Note on *Elaeis* in the East Coast of Sumatra.**)
Bull. Agric. Congo Belge 1932 : **23** : 422–71.

The author gives a very detailed account of the system of cultivation of the oil palm as practised in Sumatra together with the method of preparation of the oil and the principal diseases of the plant. In the fourth chapter is given an account of the investigations conducted with the object of improving the crop. The first section deals with the improvement of the plant. Seed is obtained from selected mother plants the flowers of which have been fertilized either with pollen from the same plant or from other selected plants. Such seed is used for direct planting or for sale. The Société Financière des Caoutchoucs has, however, proceeded further and raised families of sister plants from seed obtained after self-fertilization. Most of these trials are concerned with the Deli type and the characters taken into account are, total weight of cluster (régime), weight of fruits, weight of pulp and percentage of pulp.
A full description of the system of raising pedigree stock by the A.P.A. (Algemeen Proefstation der Algemeene Vereeniging van Rubberplanters ter Oostkust van Sumatra) is given. Pollination is readily controlled by enclosing the inflorescences in bags about a week before the spadix opens and, though male and female inflorescences are rarely open together on the same plant, self-fertilization offers no difficulty, since pollen is readily kept in desiccators for more than two months.
A full description of the method of artificial pollination is given. By this means increases of the order of 150—200 per cent have been obtained but these increases are not maintained and later yields revert to normal or even sub-normal. The reason appears to be that the palm is naturally so productive that other factors, such as nutrition, and not the number of fruits, determine yield capacity. Various modified methods of artificial pollination are described such as giving periods of rest by a rotation of the process over a number of blocks. In general, however, artificial pollination has been dropped from estate practice.

717. GOVAERT, R. 633.855.34:581.162.3
L'autofécondation artificielle du palmier à huile d'Afrique. (**Artificial self-fertilization of African oil palms.**)
6th Cong. Int. Agric. Trop. Subtrop. 1931 : **2** : 7–10.
Translucent parchment paper bags are used to isolate both male and female flowers, in the former case to prevent contamination of the pollen used with that of any other palm. The operations involved are effected by a trained native and are here briefly indicated. A form of flask with a rubber bulb for spraying the female flower with pollen is described.
Five female inflorescences where the bags had been torn and insects had entered all produced some well developed fruits. The non-fertilized flowers remained alive nearly till the maturation of the normal fruits.

RUBBER PLANTS 633.9

718. POLHAMUS, L. G. 633.913:575.127.2
Rubber plant hybrids of Madagascar species prove vigorous in U.S.
Yearb. U. S. Dept. Agric. 1932 : 329–31.
The two species *Cryptostegia madagascariensis* and *C. grandiflora* have originated from wild plants in Madagascar. A brief morphological description is given. Hybrids between them display an increased vigour and probably, as a result of this, a high rubber content.

FRUIT TREES 634

719. ADATI, S. 634.1:576.356.5
Untersuchungen über die Chromosomenzahlen bei asiatischen wilden *Pyrus*-Arten. (**Investigations on the chromosome numbers of wild Asiatic species of *Pyrus*.**)
Cytologia 1933 : **4** : 182–88.
Cytological material from the pollen mother cell of a series of wild species of *Pyrus* shewed 17 bivalents constantly present. For 16 species the chromosome numbers as found by the author and by other workers are given in tabular form. On the basis of his own findings and a consideration of other evidence the author rejects the theory that the genom constitution of the *Pomoideae* represents a triple hexasomic autotetraploid, with basic number 7 ; and he accepts, as meeting all the known facts, Sax's interpretation of the origin of the *Pomoideae* as alloploids that have arisen from an 8 x 9 chromosome *Rosaceae* species cross with subsequent chromosome doubling leading to complete fertility.

720. DRAIN, B. D. 634.1/3:575.252
Field studies of bud sports in Michigan tree fruits.
Tech. Bull. Mich. Agric. Expt. Sta. 1932 : No. 130 : Pp. 48.
The aim of the present investigation was to determine in deciduous fruit trees the frequency of bud sports, the range of characters affected, and also the value of such sports in varietal improvement. The data were obtained from observations made on apples, sour cherries and incidentally on a number of plums, peaches, sweet cherries and pears.
A large number of bud sports are individually described, and it would seem that bud sports are of frequent occurrence and that they may affect most characters of tree and fruit. The cause of these anomalies could not be discovered. In addition to the usual sectorial and periclinal chimaeras, other exceptional forms occurred.
In a number of both whole tree and limb sports, variation (or perhaps segregation) was not complete and it is suggested that some bud sports need to be fixed by selection. No morphological or cytological studies of these sports were made.
As a source of new varieties bud sports offer much greater possibilities than are commonly realized, and the selection of buds for propagation from trees of known characteristics and performance is desirable also as a means of eliminating unwanted deviations from type.

721. MYERS, C. E. 634.11:575.252
A " reverse " mutation in the apple.
J. Hered. 1933 : **24** : p. 48.
A note about a red apple tree normal except for one branch which produces poorly coloured fruits stated to be the result of a " reverse mutation " from red to green.

722. Veh, R. v. 634.11:581.162.52
Ergebnisse einer entwicklungsgeschichtlich-cytologischen Untersuchung der Samenanlagen der Apfelsorte "Schöner von Boskoop." **(Results of a physiological and cytological investigation of the development of the ovules of the Boskoop Belle apple.)**
Züchter 1933 : **5** : 77–85.

This preliminary report on the author's investigation of the internal conditions necessary to ensure the setting of fruit deals with the causes of ovular atrophy and of the failure of fruit formation. As material the Boskoop Belle variety was used which is noted for its high percentage of pollen degeneration, usually attributed to its chromosome make-up and consequent irregularities in the reduction division of the ♂ archespore. Though a complete study was made of the normal development of the ovules, it did not disclose any irregularities in the reduction division in the ♀ archespore, referred to by Kobel and other workers, though various other abnormalities and malformations and types of atrophy were found ; and the author thinks it possible that even if the meiotic irregularities cited by Kobel as the cause of ovular degeneration do occur in this variety, their role is not all-important.

It appeared that flowers without fertilized ovules were rare and that ovaries that are destined to develop normally and also those that wither may contain healthy viable embryos. Any ovary with four or even three fertilized ovules may develop and another with five or seven may wither. Embryo development in general is similar in flowers destined to develop and in those that wither ; but though in the latter type there are no signs of degeneration in the actual embryos, the rest of the ovular tissue and especially the nucellus and its epidermis shew disintegregation phenomena. The primary cause of the developmental disturbance, therefore, lies not within the embryo, but outside it. The author holds that in Boskoop blossoms that have faded naturally, failure to set fruit is probably not due to fertilization not having occurred, but to some constitutional developmental factor in the ♀ parent. The following are mentioned as possible causal factors :—

Position of inflorescence on the tree and of the flower in the inflorescence ; mutual effects of inflorescences and flowers ; influence of the stock.

Suggestions are made as to how these and other problems might be attacked in future investigations.

723. Rietsema, I. 634.11 Boskoop Belle
Over de herkomst van Schoone van Boskoop. (Reinette van Montfoort, Gulden Reinette). **[On the origin of the Boskoop Belle apple. (Reinette van Montfoort, Gulden Reinette.)]**
Fruitteelt 1933 : **23** : 86–88.

The historical origin of this apple is traced back to a reference in 1807 to the Graue Reinette von Montfort. The author believes the Boskoop Belle to have arisen possibly from a crown graft made by Ottolander ; and he points out that one of its modern equivalents, Goud-reinette, is a misnomer as an inferior apple of this name also exists.

724. *Rubtsov, G. A. 634.13
(The pear.)
Lenin Acad. Agric. Sci., Inst. Pl. Ind. Leningrad 1931 : Pp. 414.

A botanical description is given of the genus and the geographical distribution of the wild and cultivated species is discussed in relation to the origin of the pear. Two clearly distinguished groups of species exist, the western and the eastern, the former being further divided into three sub-groups. The main centre of diversity of the western group lies in the Caucasus, where whole forests occur. The main species *Pyrus communis* L. is thought to have originated by hybridization between a number of species, from all of which it has derived certain characters.

The classification of the species and of the cultivated sorts is given, together with keys, descriptions and illustrations.

The material collected by the Soviet expeditions to the centres of diversity is expected to solve

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***A fuller summary of this paper is on file at the Bureau.**

the question of origin and has provided a quantity of valuable breeding material. By the use of this material, great progress is expected in the production of entirely new forms, or the introduction of the resistance and vigour of some of the wild species into the cultivated forms.
Brief remarks are given on the technique of hybridization, the selection of seedlings, followed by an indication of the breeding work in progress in the experiment stations in different parts of the world, in summary form.
Various general questions occupy the remainder of the book, amongst which are included flowering and the influence of the pollinator, pruning and other cultural measures, handling of fruits, diseases and pests.

725. KRJUKOV, F. A. 634.22
(The plum.)
Lenin Acad. Agric. Sci., Inst. Pl. Ind. and New Cult. Leningrad 1931 : Pp. 347.
A brief botanical description of the genus is given, with illustrations. Over 250 species are known, widely distributed over the northern hemisphere and the centre of origin is yet to be determined definitely. The greatest number of representatives, however, certainly occurs in Asia.
There follows a key to the species of the plum group (*Euprunus* Koehne.) of the sub-genus *Prunophora* Focke. and of the group *Prunocerasus* of the same sub-genus.
The most frequent in the Swiss lake dwellings was *Prunus spinosa* L. Others, including *P. institia* and *P. domestica*, have also been found however, shewing the early introduction of the latter into Europe ; the specimens of the fruit suggest that they were used for food and probably dried. From about 1,300 A.D. onwards, plums were more and more cultivated, the 17th century being a period of very active development. The institia plums were of earlier introduction, starting from the 6th century B.C. and this was nearly the only species grown in North America before the revolution, largely on account of its seminal constancy. The institia plums were also cultivated by the Greeks and Romans, not *P. domestica*. Pliny mentions the latter as being of recent introduction. In all probability the Caucasus and the Caspian region is the zone of their origin, probably having been cultivated by the Huns, Turks and Tartars in pre-Grecian times. It is uncertain whether the plums of the oases of Central Asia are wild or introduced. The high quality of those described by Pliny and the absence of plums in the oldest writers on agriculture, indicates their adventive character and that those now growing wild in southern Europe are not truly indigenous.
Details of plum cultivation in the Soviet Union and other countries are given, followed by a section of considerable length on vegetative reproduction, with remarks on the stocks suitable for different sorts, on production of seedlings and on the methods of cultivation in general.
Various early systems of classification are discussed, terminating with Hedrick's system which is taken as a type for the classification of the sorts of any particular area. Descriptions are then given of the sorts grown in the Soviet Union, together with certain Japanese sorts of interest for the southern part of the Union and two native American species. The descriptions are accompanied by illustrations and indications of the origin of the respective varieties and their fertility.
There follow rather extensive sections on the utilization of the fruit and on the pests and diseases.

726. TUKEY, H. B. 634.23:581.141:578.082
Artificial culture of sweet cherry embryos.
J. Hered. 1933 : **24** : 7–12.
The following four methods of culturing aborted embryos in early varieties of the sweet cherry are described :—(1) after the stony pericarp had been split, the integuments, nucellus and endosperm were cut through and the embryo enclosed in a bottle containing 50 cc. nutrient agar. (2) Embryos from which the nucellus, endosperm and integuments had been removed were placed on agar containing glucose, and set in the light to germinate. (3) Without previous removal of the endosperm, nucellus and integuments, embryos were treated as in (2) above. In some cases the chalazal end of the seed was cut through perpendicularly to its axis to expose the tips of the cotyledons to the sunlight. (4) Seeds in which the chalazal end had been cut as in (3) were dipped in calcium hypochlorite and grown under bell jars in quartz sand watered with sterile

nutrient solution also containing glucose, the chalazal end of the cotyledons being exposed to the sunlight.
The best results were obtained on quartz sand with the embryo lightly pressed in, but not covered over.
The relation between dormancy, germination and abortion is discussed.
From the practical standpoint, it should be possible, using this technique, to introduce the early ripening character on the ♀ side too into crosses in which hitherto this character could only be introduced by the male.

727. TUKEY, H. B. 634.23:581.481
Embryo abortion in early-ripening varieties of *Prunus avium*.
Bot. Gaz. 1933 : **94** : 433–68.
This paper presents a critical comparison of the embryogeny and fruit development of early and late ripening varieties of the sweet cherry *Prunus avium*. Normal development and the correlation of the development of the various parts is described in a late ripening variety producing a high proportion of viable seed and in an early ripening variety producing few or no viable seeds. It was found that the onset of the period of rapid growth of the ovary and its contents, though coincident with fertilization is not necessarily initiated thereby. There was no apparent marked structural variation in abortive embryos—abortion being represented by a sudden arrest in development.
From general considerations of the conditions of plant metabolism, the author inclines to think that embryo abortion causes the second period of rapid development of the pericarp and not vice versa. The factors underlying the phenomenon as determined from cross-breeding records are due to physiological and nutritional, not genetic, causes involving the ♀ only, although the suggestion is mentioned that embryo abortion might be a varietal character which is responsible for early ripening in some varieties.
The evidence that the problem is nutritional is afforded by the author's successful artificial cultivation of normally abortive embryos (see preceding abstract).

728. VOINOFF, G. 634.3:575.127
(The American citrus hybrids.)
Subtropics 1931 : 3rd year ed. No. 3 (10) : 106–12.
The importance of obtaining cold-resistant citrus capable of cultivation in the U.S.S.R. is mentioned and various interspecific citrus hybrids in which the cold resistance of the trifoliate orange has been transferred are referred to ; the majority of these are the citranges, citrangequats, limequats, etc. produced by North American workers. They remained undamaged in the Crimea in the winter of 1928/29 when temperatures of —14°C. were experienced. The Morton citrange and Thomasville citrangequat were most promising and these are described more fully.

729. TORRES, J. P. 634.3:575.127.2
Progress report on citrus hybridization.
Philipp. J. Agric. 1932 : **3** : 217–29.
The object of the work described in the report is the production of hybrids superior to either parent, a term which embraces, besides eating quality, growth habit and, particularly, resistance to rindborer and canker disease. Experimental work was commenced in 1928. Notes are given on pollination, which shews considerable varietal differences, and the technique of hybridization. A list of crosses, both inter– and intraspecific, is given.

730. 634.37
BOBONE, A. DE L. A. 634.37:576.312.32
Contribuíção para o estudo taxonómico da espécie *Ficus carica* L. **(Contribution to the taxonomic study of the species *Ficus carica* L.)**
Anais Inst. Sup. Agron. Lisboa 1932 : **5** (2) : 124–242.
An account of the system of classification and the characters on which it is based, followed by descriptions of a number of Portuguese varieties, with illustrations and a key to their identification.

The second part is devoted to a study of the chromosomes of four of these varieties, made on root tip material. A diploid number 26 was observed in all four varieties, one of which belonged to the Smyrna group, the others to the Adriatic group, but of very different types. The chromosomes were divided into four groups according to size. The chromosomes were identical in all varieties and varietal differences are evidently independent of chromosome differences.
The third part consists of a description of the development of the flower and fruit.

731. CONDIT, I. J. 634.37:576.312.32
Cytological and morphological studies in the genus *Ficus*. II. Chromosome number and morphology in thirty-one species.
Univ. Calif. Pub. Bot. 1933 : **17** : 61–74.
The chromosome number, size and morphology are described and figured for the species belonging to four subgenera. In all species studied the diploid number 26 was observed.
The chromosomes of the three interfertile species *F. carica*, *F. pseudocarica* and *F. palmata* are practically identical.

732. KERN, E. E. 634.38
(Mulberry tree.)
Lenin Acad. Agric. Sci., Inst. Pl. Ind. Leningrad 1932 : No. 47 : Pp. 91.
Indications are given of the varieties cultivated in different parts of the world, and of the considerations which influence the choice of plant. Amongst these resistance to frost and diseases, suitability to climate and soil conditions, high leaf and low fruit formation, form of tree and leaf, and quality of the latter are mentioned.
The botanical and biological features of the tree are very briefly described.
The various uses of the tree and berries are described, followed by its cultivation and various methods of propagation, cuttings, layering, budding and grafting all being applied. Reference is made to various pests and finally to the prospects of cultivation in the Soviet Union.

733. TACHDJIAN, E. 634.651:577.881
État actuel de nos connaissances sur le papayer. **(The present state of our knowledge of the papaya.)**
Rev. Bot. Appl. Agric. Trop. 1933 : **13** : 196–201.
In a short introduction on the various species of the genus, 14 different sexual types of *Carica Papaya* L. are mentioned. A similar diversity prevails in the proportions in which the various types may occur in a population, an instance being cited in which 19 plants from the seeds of one fruit shewed a ratio of 7 ♂♂ : 12 ♀♀ and of them 17 were monoecious and 2 bisexual as well as monoecious.
The Hawaii Experiment Station is attempting to breed a hermaphrodite strain and has demonstrated the possibility of increasing the percentage of fruit-bearing plants ; but unfortunately no means of early sex diagnosis has yet been discovered. Various types cross readily, but so far it has been impossible to fix types by crossing.
In conclusion methods of cultivation are outlined. A short list of variants in Brazil is given.

734. DARROW, G. M. and WALDO, G. F. 634.75:575(73)
Berry breeders seek new varieties adapted to specific purposes.
Yearb. U.S. Dept. Agric. 1932 : 113–14.
The objectives of berry breeding in the United States are outlined.
The qualities of existing varieties which recommend them for the different markets must first be considered. Resistance to various diseases, thornlessness, and various industrial qualities are among the most important.

In spite of its great success as a canning strawberry Ettersburg 121 is not well adapted for other purposes and as a result of hybridization the new varieties Corvallis and Redheart, combining its desirable features with other qualities, have been produced.
Selections of wild berries from various parts of the world are also being made for use in breeding.

735. Kobel, F. 634.835:575
Die Aussichten der Immunitätszüchtung bei der Rebe. (**The prospects of immunity breeding in grapes.**)
Landw. Jb. Schweiz 1933 : **47** : 248–71.

The object of this investigation was to ascertain whether in vine breeding, high yield and quality, and resistance to peronospora could be combined. Various species hybrids of the *Euvitis* group were studied with the following results.
The Mendelian inheritance of sex and autumn foliage colour was confirmed ; the colour of the grape juice was also found to be conditioned by a Mendelian factor pair ; and Mendelian segregation of winterhardiness was observed in F_2. Resistance to peronospora proved too complex for successful analysis.
The extreme difficulty of the genetic analysis of characters important in the breeding of direct producers is pointed out ; but the author evolved a scheme whereby he was able approximately to determine from the major part of his material (343 F_1 hybrids, 112 backcrosses and 590 F_2 hybrids) the likelihood of obtaining individuals of the desired type.
The chances in 100,000 are about four, according to the results of backcrossing and about six from the data for the F_2 hybrids ; but if the F_1 were subjected to extremely severe selection, not more than one in 100,000 would meet the requirements. The F_2 hybrids appear to offer the best chance of success. The following breeding programme is suggested :—
(1) Production of F_1 hybrids using high quality *vinifera* varieties and *Berlandieri-riparia* forms.
(2) Careful selection of F_1 followed by intercrossing or crossing with existing superior F_1 hybrids such as Oberlin 595.
(3) Continued breeding from the best F_2 forms either by crossing *inter se* or with superior F_2 hybrids.

736. Baur, E. 634.835:575(43)
Der heutige Stand der Rebenzüchtung in Deutschland. (**Present state of grape breeding in Germany.**)
Züchter 1933 : **5** : 73–77.

A severe but constructive criticism of German vine breeding containing the following three suggestions for future improvement :—
(1) The most prolific and otherwise superior types from existing clones of the different varieties should be selected in vineyards and used as cuttings for the renovation of future vineyards.
(2) From crosses of American and European varieties reliable phylloxera resistant stocks suitable to German soil and climate should be obtained. Since large areas would be planted with grafted vines the question of infection of existing vines would not arise, and only sufficient resistance to ensure no damage to the roots by phylloxera would be necessary.
Emphasis is laid on the fact that very large numbers of seedlings would have to be bred. Work on such a large scale would necessitate some method being evolved whereby it would be possible to identify resistant seedlings in the seed bed or at latest at the first transplantation. As many resistant types as possible would be chosen from these seedlings and then those that were best from the standpoints of varietal types and at the same time of suitability to the different kinds of soil would be selected for use as stocks.
(3) In breeding direct producers resistant to both phylloxera and mildew, again for the same reason, a high degree of resistance would suffice. The combination of high quality with resistance to both phylloxera and peronospora would be obtained by breeding direct producers resistant to peronospora and grafting these on to phylloxera resistant vines.
The methods at the Müncheberg Institute for Genetics where 5—7 million F_2's are raised yearly are described ; and it is suggested that this Institute with its equipment should be utilized in a large scale breeding campaign involving 5—10 million seedlings a year.

737. STUMMER, A. and FRIMMEL, F. 634.835:575(43.72)
Bericht über die Rebenzüchtungs-arbeiten des Jahres 1932. Deutsches Gebiet von Mähren. (**Report on the work of grape breeding in 1932. German Territory of Moravia.**)
Verlautb. deuts. Sekt. mähr. Landeskulturrat. 1933 : No. 1/2 : 2 pp.

Various combinations which have yielded hybrids of promise are enumerated, those with Malingre being the most favourable. Amongst these latter appeared most of the early maturing ones found.

Some of the American x *vinifera* hybrids were quite free from the wild flavour. Selfings of Malingre were again of interest, also of Veltliner grün and Gutedel.

Die Rebenzüchtung in Südmähren. Ein Zehnjahresbericht 1922-1931. (**Grape breeding in South Moravia. A decennial report 1922-1931.**)
Sbor. Vyzkumn. Ust. Zem. CSR. 1932 : **94** : Pp. 71.

Brief remarks are made on the results of selections carried out in the period 1921—1930, observations being made on 343 plants. High productivity was the main feature, no clear differences being observed in resistance to pests and diseases.

As soon as a differentiation into high and low yielders was observed within the different varieties clones were made, and tables are given shewing the yields of different lines of certain of the varieties and of the clones from some of these lines. In some varieties certain outstanding lines were discovered, by selecting which very considerable improvement could be effected ; this was the case in Veltliner rot and Rheinriesling rot, the outstanding lines being also slightly higher in sugar content.

Certain lines seemed to suffer less from frost damage.

The method of hybridization is described. Not more than 10 per cent success was obtained. Certain combinations were particularly difficult and Malingre invariably failed as female and Sylvaner grün and Neuburger as male parent.

The objects of breeding and recommendations are made of parents suitable for particular purposes. Amongst these a number of American species figured, for the production of direct producers suited to the district. For this the Berlandieri x Riparia vines were used to the greatest extent and special attention was paid to the promising Aramon x Riparia 143 B (see " Plant Breeding Abstracts," Vol. II, Abst. 147). A few American x American crosses were studied in addition to American x *vinifera* and also a number of reciprocal crosses and selfed progenies obtained both by bagging and free pollination. In connexion with the latter the remarkable heterogeneity of the progeny is emphasized. This applies both to selfings of *vinifera* and American x *vinifera* hybrids.

The method of treating the seed material is described. A cold 0.25 per cent solution of uspulun greatly enhanced the germinating capacity of the seeds. The percentage germination of hybrid seeds was 17.3 per cent greater than that of selfed seeds ; the number of seedling casualties and of various seedling anomalies was also greater among the latter and the vigour of growth markedly less. The number which perished in later life, however, was less.

The *vinifera* crosses involving Riesling and Gutedel were especially favourable, some being amongst other things medium early. Certain excellent individuals were also obtained from Veltliner frührot x Riesling.

The long pedicel of Welschriesling seemed to be dominant in all crosses.

From selfing Malingre as many as 5 individuals of promise were obtained, being rather early, with larger bunches and fruits than the parent variety. The progeny shewed the widest possible variation especially in time of ripening.

The American x *vinifera* hybrids were in general undesirable and are to be further crossed with European varieties. Selfing of such hybrids has produced certain not unpromising segregates. The majority of hybrids shewed a preponderance of the characters of one or other of the parents, although some deviated from both. Very many hybrids developed red pigment in leaves and young shoots where none was present in the parent.

A bifactorial inheritance was determined for the number of nodes without branches at the base of the vine, early branching being dominant. Three chlorophyll factors were established, the absence of all producing albinism. Variegation arises from vegetative segregation of individuals heterozygous for one and recessive for the other two factors.

No success was obtained or is anticipated in the production of graft hybrids.
Various colour and other mutants were observed. The behaviour of variants for grape colour indicated that they were mutants rather than phenomena of xenia. These colour mutations were in certain cases accompanied by size differences.
In view of the changes which have come about in the plant under the influence of cultivation the author considers that a further increase in productivity by still greater hypertrophy of the reproductive organs is by no means beyond the bounds of possibility. The same opinion is expressed with regard to increased quality and the production of successful direct producers. Emphasis is laid on the fact that the characters on which the value of cultivated grapes depends are really monstrosities and mostly recessive, thus inbreeding is very necessary for their isolation in the pure state.

738. DEGRULLY, L. 634.835.093
Un hybride qui produit d'excellent vin. Rupestris x Oeillade de Pierre Castel, No. 19637. (**A hybrid which produces an excellent wine : Rupestris x Oeillade de Pierre Castel, No. 19637.**)
Prog. Agric. Vitic. 1932 : **97** : 205–10.
This hybrid is shewn to be resistant to diseases and moderately productive. Some remarks are made on its cultivation and on wine-making.

739. NAVARRO, A. F. 634.836
Da diagnose das ampelídeas híbridas do género *Vitis*. (**The diagnosis of hybrid vines of the genus *Vitis*.**)
Anais Inst. Sup. Agron. Lisboa 1932 : **5** (2) : 26–123.
" The analysis of the phenotypes of certain organs, in this case the leaves, enables us to a large extent to recognize the genotypical constitution of hybrid forms." This affords a means of diagnosing hybrid plantations with a considerable degree of certitude, which should of course where possible be substantiated by cytological and genetical observations.
The various contributions to the classification of vines are described in some detail, from the first attempts of Democritus up to the present day, including metrical and anatomical methods. Attention is called to the characteristic heterozygosity of *Vitis vinifera* and the resemblance displayed by some of its variants to certain American and Asiatic species. A heterozygous vine is observed to display at a certain level a maximum resemblance to one species, above or below which the characteristics of the other species gain force, reaching their maximum at a different level. In hybrids of *V. riparia* x *V. vinifera* for example the terminal section of the branches displays the most pronounced expression of certain *riparia* characters ; many characters of *V. rupestris* on the other hand manifest themselves most markedly at the base of the branches of its hybrids.
A thorough study of the various species has led to the conclusion that many so-called varieties of certain Linnean species are in reality complex hybrids, in which *V. rupestris*, *V. aestivalis* and *V. Labrusca* have played a frequent part.
The various characters of the leaf and stem on which the study was based are described in some detail, those species illustrating the different degrees and types being indicated.
The principles are illustrated by reference to four hybrids of known parentage, descriptions and illustrations of which are furnished for the various " genetic levels." The hybrid *Cordifolia* x *Rupestris* Jardin (Malegue) for instance in addition to the " genetic levels " for the two parents, displayed one corresponding more or less to *V. riparia* ; in addition there were regions characterized by complicated mosaics of the two parental characters of the species. The hybrid *Cordifolia—Rupestris—Rupestris* Malegue—*Riparia* had three " genetic levels " corresponding to the three parental species, joined by transitional sections and mosaics. The hybrid *Riparia* x *Rupestris* 3309 (Couderc) displays characters of *V. riparia*, *V. rupestris* and *V. monticola*, which latter species is thought to have participated in its origin.
Instances are then quoted of unknown hybrids which have been identified by this method, the first as *V. riparia* x *V. aestivalis* x *V. rupestris*, the second, the hybrid Champin, which by Ravaz was ascribed to *Rupestris* x *Candicans*, was shewn to contain also *V. riparia*, *V. aestivalis* and *V. cordifolia*.

740. DALMASSO, G. 634.843.2.09
Riparia x *Rupestris* 3309 Couderc. (Risultati di un'inchiesta.) [*Riparia* x *Rupestris* 3309 Couderc. **(The results of an inquiry).**]
Ann. Sper. Agr. Roma 1930 : 5 : 153–86.

This hybrid stock, at one time widely cultivated and generally recommended, has shewn signs of degeneration due to a disease resembling " roncet."
The article consists mainly of the reports of growers and investigators on the problem from various parts of Italy.

741. STOUT, A. B. 634.872:581.48:575.12
New hardy seedless grapes.
Science, 1933 : 77 : 310–11.

The New York Botanical Garden reports that 28 grape seedlings that bear seedless or nearly seedless fruits have been obtained by crossing the hardy seeded type with tender seedless varieties. This seedless condition is believed to be due to the action of complementary factors. The " seed " may be either rudimentary or nearly as large as the ordinary grape seed owing to the development of the seed coat tissues ; but even in the latter case the structures lack embryo and endosperm or exhibit only traces of them and are therefore soft and pulpy and not noticeable in mastication.
It is believed that this type of seedlessness corresponds to that of the pollen parent ; but that the inhibition of development resulting in seed abortion is less complete in most of these plants. The yield is good as regards quantity and size of fruit, and various colours were obtained. Tests are being made under cultural conditions.

742. ROUSSOPOULOS, N. C. and MEÏMARIS, C. M. 634.873.4:575.252:575.42
Le choix des plants et les mutations gemmaires en viticulture à propos du raisin de Corinthe. **(The choice of plants and bud mutations in viticulture with reference to currants.)**
Rev. Vitic. Paris 1933 : 78 : 21–25.

The entire dependence on vegetative propagation in this plant makes the choice of planting material and of bud sports of peculiar importance. The currant probably owes its origin to bud mutation and much further improvement is probably possible by means of careful bud selection.
The absence of sexual reproduction makes it impossible to test whether these sports are always true mutations. This is however of minor importance from a practical point of view, if they are transmissible vegetatively and illustrations are given of notable improvements which have been brought about in this way. One of these is a selection which yielded bunches weighing 383–400 g. as compared with 79 g. for a normal bunch. The opinion is expressed that improvements of a similar nature could be brought about in ordinary vines.

FORESTRY 634.9

743. WETTSTEIN-WESTERSHEIM, W. v. 634.94:575
Zur Frage der Züchtung von Forstpflanzen. **(The question of breeding forest plants.)**
Z. Züchtung 1933 : A. 18 : 357–69.

Although the demands of different generations differ widely with respect to certain plants, there are many characters which are in all ages desirable, such as erectness of growth, vigour and healthiness.
Brief mention is made of early efforts in forest plant breeding and the lack of international co-operation deprecated. A forest plant breeding union for the whole of Germany was founded in 1932.
In illustration of the success to be expected the discovery of a pine tree free from *Brunchorstia destruens* is quoted, from which a progeny of 400 immune plants was obtained. It is now known that races from different regions differ in resistance and it is expected that the same holds for other diseases too.
Many well-known tree forms are F_1 hybrids and the practical application of hybrid vigour in tree production in general is advocated. The possibility of vegetative reproduction makes this even more simple. The use of species hybrids seems to have especial promise.

The importance of individual variations is emphasized and these being conditioned both genetically and environmentally, the recognition and selection of the best genetically conditioned individuals is the first important step in breeding. This is achieved by selection based on progeny tests. Observations over five years are usually sufficient, much can be learnt even from seedling observations—e.g. heliotropic tendencies can be detected in the first few weeks.
The so-called climatypes, resulting from natural selection, have proved to be just as heterogeneous as land races of cereals and the like.
The possibility of effecting crosses on twigs in the greenhouse often facilitates hybridization work. When vegetative propagation is not possible and the F_1 itself does not display the requisite characters or combination of characters further generations must be produced by growing large patches of F_1's, as nearly as possible protected against cross-pollination. Rapid flowering can sometimes be induced by grafting or pruning, etc.
It is further possible that profitable mutant forms may be found.

744. Busse. 634.972:575
Forstpflanzenzüchtung. (**Forest plant breeding.**)
Deuts. Forstztg. Neudamm 1932 : **47** : 738–42.

A plan for forest improvement in Germany by pedigree breeding of trees based on prolonged selection and progeny breeding is outlined as follows :—a preliminary selection of potential parents with a good general phenotype with due regard to suitable ages for the various types of wood and to environmental factors (soil, climate, situation) which should not be extreme. The seed from each of these selected trees is collected separately and from standing trees only, so that the process might be repeated later. At this stage detailed observations would be entered on a standard form and the trees provisionally numbered. The individual lots of seed would be then sown separately in the same forest area as that of the parent tree and their development observed. Planting out would be done each year or every second year according to the species, control rows of any average local variety being interspersed between the test seedlings.
For comparison, this process would be repeated if possible with the same parent trees yearly, and reactions to environment, hardiness, etc. could be estimated. The seeds obtained at each repetition should be sown as far as possible in the same ground and the seedlings transplanted to the same area as had been originally used. The first progeny from the various original parents are judged annually in autumn. Selection is based not on excellence of individual seedlings, but on the general excellence of the progeny as a whole. The final extremely severe selection from the original parent trees would be made at the end of 5 years so that the entire process of progeny testing would take at least 10 years. About 10 per cent of the total tested would be selected.
From the selected parents (possibly about 10 per cent of the total tested) seed would again be collected and sown as before ; but the seedlings though kept separate could be now grown collectively in a nursery carefully chosen for situation, etc. Early fruiting might be encouraged by various methods so as to ensure as much intercrossing between the various selected stocks, so that the paternal inheritance might be improved. Again the progeny would be judged, the selected seedlings (10 per cent possibly) specially nurtured as before, and from these only seed would be collected in the future. Then finally from this surviving 10 per cent of progenies from the nursery (each of which is represented by a fairly large number of generations), individual strains would be selected and used for future breeding, their seed being sown as in the initial test but their seedlings being transferred direct from the woodland to the nursery, then judged, and so on, as before. In discussing the practical requirements for such a programme special emphasis is laid on a policy of centralization and uniform methods of recording, both of which are essential for a proper evaluation of the results.

745. Fleischmann, R. 634.973:575
Beiträge zur Robinienzüchtung. (**Contributions on *Robinia* breeding.**)
Züchter 1933 : **5** : 85–88.

A description of some experiments made to ascertain the possibilities of breeding *Robinia pseudoacacia* which is used for timber, fuel and in the formation of wind breaks. Two types are found, one producing abundant flowers, the other almost without flowers. Future breeding

problems might investigate these two types and the problem of producing an ecotype well adapted to an arid climate.
Seventeen ♀ parent trees were selected which apparently shewed definite differences in seed weight in quantity of flowers produced and in stem girth. The seed was collected separately and sown. One specimen was obtained which was regarded as superior to others including certain trees from American seed.
A preliminary study was made of thorn length as one possible distinguishing morphological character. Beyond these no very definite results were obtained.

746. Polansky, B. and Vacl, V. 634.975:575.12
Několik předběžných zhoušek s umělým opylováním u lesních dřevin jehličnatých. (**Preliminary experiments on artificial pollination in forest gymnosperms.**)
Věst. (Bull.) Českoslov. Akad. Zeměd. 1933 : 9 : 283–85.
At the State Research Institute for Forestry at Brünn the following species have been used in an investigation on artificial pollination :—*Abies pectinata* DC. and *Abies balsamea* Mill. ; *Picea excelsa* L., *Picea pungens* Engelm, *P. Engelmannii* Carr., *P. sitchensis* Carr. ; and *Pinus silvestris* L., *Pinus Banksiana* Lamb and *Pinus contorta* v. *Murrayana* Eng. v. *Bolanderi* Parl. In *Abies* and *Picea*, unpollinated ♀ flowers form cones with empty seeds which in *Abies* are indistinguishable from normal seeds, but in *Picea* are smaller and lighter than normal type. In *Pinus* ♀ flowers if not pollinated, develop no cones and wither and fall off.
Reciprocal intervarietal crosses in *Abies* and *Picea* always resulted in cone formation with full or empty seeds ; but the ♀ flowers of *Pinus* failed to develop and withered away. In *Picea* seeds from cross pollination differ definitely in colour and weight. Hybridization can apparently be performed with ease in both *Abies* and *Picea* ; in the former the phenotype shews very little variation whilst in the progeny of the latter considerable variation was observed. *Pinus* lends itself with difficulty to crossing. Further investigation is required.

VEGETABLES 635

747. Walker, J. C. 635.34–2.484–1.521.6
Cabbage variety Jersey Queen adds early strain resistant to yellows.
Yearb. U.S. Dept. Agric. 1932 : 119–21.
Until recently, no early variety resistant to yellows has been available. This has now been obtained by a strain selected from the susceptible Early Jersey Wakefield. This strain, named Jersey Queen, was obtained by selecting the few plants surviving a heavy attack. A brief description is given.

748. Nelson, R. and Cochran, L. C. 635.53–2.4–1.521.6
"Michigan Golden." A new celery resistant to yellows.
Quart. Bull. Mich. Agric. Expt. Sta. 1932 : 15 : 102–06.
After a severe outbreak in 1929 of a fungous disease not defined but referred to as "yellows," selection for resistance to this disease resulted in the discovery in 1930 of a highly resistant variety "Michigan Golden" which also has other commercially valuable qualities. Selection is still in progress to fix the most desirable stalk characters. The comparative resistance of the different varieties is shewn in a table.

749. 635.64:575.12
Porte, W. S. 635.64 Break o' Day
Tomato variety called Break o' Day succeeds in far scattered tests.
Yearb. U. S. Dept. Agric. 1932 : 373–76.
This is the outstanding result of a cross of Marglobe x Marvana. It combines the fruit size, shape and quality of the first with the earliness of the second. Its foliage is scanty, which makes the fruits visible to the picker. It is resistant to *Fusarium* and other diseases and, to a certain extent, to drought. It develops a scarlet colour except at high temperatures.

750. LINDSTROM, E. W. and HUMPHREY, L. M. 635.64:576.356.5
Comparative cyto-genetic studies of tetraploid tomatoes from different origins.
Genetics 1933 : **18** : 193–209.
See " Plant Breeding Abstracts," Vol. III, Abst. 537.

751. CHMELAŘ, F. and ŠIMON, J. 635.651(43.7)
Výsledky pokusů se zušlechtěnými odrůdami bobu v letech 1931–1932. **(Results of experiments of 1931-1923 with varieties of *Vicia Faba* obtained by breeding.)**
Věst. (Bull.) Československ. Akad. Zeměd. 1933 : **9** : 127–34.
A series of Czecho Slovakian and foreign varieties were sown in order to determine the time of ripening, and morphological character of the plants, and the yield and composition of the seeds. The results are given in a table.
In 1932 *Vicia Narbonnensis* was also tested for comparison.

752. STERN, C. 635.651:575.113.7
Zur Deutung eines letalen Effekts in Kreuzungen zwischen *Vicia Faba major* und *Vicia Faba minor* (nach Versuchen von M. J. Sirks). **[The interpretation of a lethal effect between *Vicia Faba major* and *Vicia Faba minor* (based on experiments of M. J. Sirks).]**
Z. indukt. Abstamm.– u. VererbLehre. 1933 : **64** : 169–72.
A new explanation is offered for the phenomenon observed in this cross by Sirks (see " Plant Breeding Abstracts," Vol. II, Abst. 518) whereby 25 per cent of the zygotes, namely all those containing a particular chromosome, were eliminated in *minor* plasma. It is assumed that a particular lethal is present in the chromosome and that in crosses between the two subspecies no crossing-over between the *major* and *minor* chromosomes occurs. The hypothesis will be tested by examining whether crossing-over of the other 6 factors in this chromosome occurs in crosses between the subspecies, a question which has not yet been studied.

753. LAMPRECHT, H. 635.652:575.11.061.6:581.48
Zur Genetik von *Phaseolus vulgaris*, VI. Vierter Beitrag zur Vererbung der Testafarbe. **(On the genetics of *Phaseolus vulgaris*, VI. Fourth contribution on the inheritance of the colour of the testa.)**
Hereditas 1933 : **17** : 249–316.
In continuation of previous work (see " Plant Breeding Abstracts," Vol. II, Abst. 522, Vol. III, Absts. 128 and 129) the author describes a further series of testa colours as exhibited in 4 crosses comprising altogether about 20,000 individuals in F_2 and F_3. Of the 6 factors mentioned, C, J, G, B, V and R, the last is not discussed in the present paper. Different combinations of the 6 genes result in different seed coat colour with the exception of 2 genotypes PP CC JJ GG BB VV rr and PP CC JJ gg BB VV rr both of which produce a pure black testa. The hilum margin is affected by different combinations of C,V and R, which produce white, while gene combinations containing any one of J, G or B result in a coloured hilum margin.
The colouring of the caruncle shews corresponding variations. So far dominance of the 4 genes J, G, B and V has proved complete ; but C in heterozygous form has invariably produced marble, and produces self colours in the homozygous state only. It is interesting to note that phenotypically the heterozygotes for C are spotted mosaics of the two colours found in the respective homozygous types.
Up to the present only one instance has occurred in which a certain heterozygous combination PP CC JJ gg Bb Vv rr is not the same colour as the corresponding dominant homozygous combination PP CC JJ gg BB VV rr. One other pair of genes influencing seed colour Vir-vir has been studied. It produces an effect only if either C or C and B are present with P, but at the same time J is missing. Its action results in greenish shades in the seed coat.
Another gene pair Mar-mar which in certain genotypes results in a broad coloured border outside the hilum margin is also discussed.

754. 635.655
TALANOV, V. V. (Editor) 633.15
(The "sorts" of grain crops and the regions of their distribution. III. Soya bean and maize.)
Lenin Acad. Agric. Sci., Inst. Pl. Ind., Division Var. Tests, Leningrad 1932: Pp. 340.

The two crops are dealt with on lines similar to part I. (See Abst. 614 above). In addition, the classification question is discussed in connexion with soya bean; in this crop the character of greatest moment is earliness and the lines are arranged according to this character, which is closely correlated with low stature and also low insertion of beans, the latter an undesirable character for mechanized harvesting.
Special chapters are devoted to the quality and composition of the seed.
The best early lines selected by stations in the Soviet Union suffer from seed shedding at maturity, others from coloured seeds. The production of a type with high insertion of the lowest beans was accompanied by reduced yield and the solution to this problem is thought to lie in the improvement of the harvesting machines and not the plant.
Great hope for future breeding is centred in the recent collections of soyas from the Far East.
The treatment of the maize is exactly similar to that of the wheats in part I, the sorts being arranged according to earliness.

755. KOERNICKE, M. and RIEDE, W. 635.655:575(43)
Die Soja-Züchtungen des Botanischen Institutes der Landwirtschaftlichen Hochschule Bonn-Poppelsdorf. **(Soya bean breeding in the Botanical Institute of the Landwirtschaftlichen Hochschule Bonn-Poppelsdorf.)**
Z. Züchtung 1933: A. 18: 341–56.

Extensive introductions followed by yearly selection of over 1,000 plants has been practised for many years. The only forms suitable to the German climate are the North Manchurian forms, of which a great abundance exists.
The different types and different uses of the plant are briefly described and remarks made upon cultivation and the considerations which should direct the breeding programme. Individual plant selection is the method recommended; mutation is not infrequent and some of the mutants have yielded types of improved commercial value. Spontaneous crossing has also occasionally given improved types. After considerable practice artificial hybridization can be applied.
The station has already produced improved lines suitable for German conditions and for the various purposes.

756. WOODWORTH, C. M. 635.655:575.1
Genetics and breeding in the improvement of the soybean.
Bull. Ill. Agric. Expt. Sta. 1932: No. 384: 297-404.

This lengthy (pp. 104) bulletin brings together information on soya bean genetics gathered in the course of sorting out the hundreds of varieties introduced into the United States.
After a description of the plant an account is given of its method of reproduction. Pollination occurs as, or a little before, the flower opens and self-fertilization is the rule. Natural crossing, however, occurs and the evidence indicates some 0·08 per cent. The agent is believed to be mainly a thrips (*Thrips tabaci*). Artificial crossing is difficult owing to the small size of the flower and absence of adequate pollen in the right stage of development.
The inheritance of a large number of seed and plant characters is considered. Of particular interest is the inheritance of cotyledon colour. Superimposed on two genes (D_1 and D_2) for yellow which are both dominant and independent, there is maternal inheritance of green colour. The four main seed-coat colours are black, brown, green and yellow, of which black is dominant to brown and green to yellow. There is, however, a multiple allelomorphic series affecting inhibition of the black or brown pigment which is limited to the hilum (I), occupies restricted areas (i^r and i^k) or is completely absent (i). Mottling, consisting of patches or bands of black or brown, appears to have a genetical basis, but also appears to be influenced by environmental conditions. Hilum colour is governed by three Mendelian factors, R_1 and R_2 giving brown hilum in dissociation and black hilum in association, and T giving tawny pubescence, but in

association with R_1 or R_2 it also intensifies the brown colour. Abnormal hilum (3 : 1), defective seed coats (15 : 1, one factor being I) and bloom of seed coat (27 : 37 indicating manifestation only when all three genes are present) are also discussed.
There are two distinct glabrous forms, one of which is dominant to pubescent and the other recessive. Pubescence is due to a factor (P_2) and the dominant glabrous form possesses also an inhibiting factor (P_1). Among other characters which have been studied may be mentioned maturity which appears to be dependent on a number of genes except in one case late maturity was dominant and associated with a tall habit (3 : 1). Observations are also given on the occurrence of sterile and variegated plants.
The chromosome number of the soya bean is 20 haploid. So far three linkage groups have been determined. Group I contains R_2, T and De (defective seed coat) all three having the same locus, and E (early maturity) located approximately 6 units away. Group II contains P_1 and R_1, completely linked, and M (mottling) located 18 units away. Group III contains D_1 and G_1 with about 13 per cent crossing-over.
There follow several pages devoted to a general discussion of variation and methods of breeding from which the following facts relating to the soya bean are noted. Mutations have been observed and a list is given ; varieties with hard coated seeds are known and in the cross involving hard coat in one parent (S.P.I. 65388) all possible gradations of hardness are found in the F_2 including transgressive inheritance in both directions ; hybrid vigour has been demonstrated with a number of characters.
Following the methods adopted in the case of corn, experiments were started in 1914 to secure by continuous selection plants having high and low contents of both protein and oil. These were, however, unsuccessful and, in 1922, a further attempt to isolate strains with high and low oil content was successful. The oil content of each strain varied markedly from year to year but a significant difference of some 2·5 per cent existed between the high and low strains. There is here a genetic difference shewing slight evidence of transgression when high and low strains are crossed. Selection for quality of oil as determined by the iodine number has resulted in isolating within a pure line strains with iodine numbers 133·7 and 124·9 respectively.
The considerable volume of work on varietal resistance to various diseases is reviewed.
That important character of the soya bean, yield of seed, is analysed in some detail through its component factors, number of nodes per plant, number of pods per node, number of seeds per pod, percentage of abortive seeds and seed size. The only correlations satisfying Fisher's criterion (P=·01) are yield and average weight of 100 seeds (positive), and yield and percentage of abortive seeds (negative) while of the components themselves the only significant correlations are between number of nodes and average weight of 100 seeds and percentage of abortive seeds and average weight of 100 seeds (both negative).

757. 635.656(43.7)
CHMELAŘ, F. and ŠIMON, J. 635.658(43·7)
Nové zušlechtěné odrůdy hrachu a čočky a jejich užitkové vlastnosti. (**New improved varieties of peas and lentils and their practical value.**)
Věst. (Bull.) Českoslov. Akad. Zeměd. 1933 : **9** : 109–17.
Varieties of *Pisum sativum*, *P. arvense* and *Lens esculenta* were grown during the years 1925 to 1932 in order to determine their time of flowering and ripening. The results are tabulated.
A classification of the varieties tested is presented. *P. sativum* and *L. esculenta* are classified according to colour and size of seeds, and *P. arvense* according to colour.

758. BOURDOUIL, C. 635.656:575–183:581.48
Remarques sur le poids des graines hybrides chez le *Pisum* en première génération. (**Observations on the weight of the seeds in the first generation hybrids of *Pisum*.**)
Bull. Mus. Hist. Nat. Paris 1932 : **4** : 777–79.
In crosses of a number of different varieties of round by wrinkled peas the ratio between the weight of the hybrid seeds and that of the maternal parent invariably approximated to unity, regardless of the ratio between the two parents. The weight appears therefore to depend entirely on the nutrition of the ovule by the parent plant. Owing to hybrid vigour the ratio

tended in all cases to exceed 1. This effect is at its maximum when the parents most nearly resemble each other in size, with the result that the wrinkled x round hybrids are nearly as round as the reciprocal.
In the crosses made with the wrinkled parent the ovary was always larger and the success was greater with this as female. The cross Arras ♀ x *P. arvense* ♂ (2 round varieties) was however more successful than the reciprocal.

759. SNYDER, W. C. 635.656–2.484
A new vascular *Fusarium* disease of peas.
Science 1933 : **77** : p. 327.
A new *Fusarium*, similar to the wilt, *F. orthoceras* v. *pisi*, but attacking varieties immune to the latter.

BOOK REVIEWS.

GUILLIERMOND, A., MANGENOT, G. and PLANTEFOL, L. 576.3
Traité de cytologie végétale. (**Treatise on plant cytology.**)
Librairie E. Le François, Paris, 1933 : 250 fr. Pp. vi+1195. 464 illus.
The subject is treated on a very broad basis, not only as a study of nuclear phenomena, but of the life of the cell as a whole. A large part of the volume is devoted to the properties of the cytoplasm and its various inclusions, the nucleus and the methods of cell division in various plant groups receiving passing reference only. The functions of the various cell bodies receive due attention, as do also the constitution of the protoplasm and general physiology of the cell, the phenomena of irritability and the formation of chlorophyll, starch and other materials. The different types of fertilization, the alternation of generations in different groups, the different forms of apospory and the mechanism of sex determination are also discussed, together with the sundry hereditary phenomena associated with chromosome behaviour.
The volume terminates with a bibliography covering 110 pages, and author and subject indexes. It is well illustrated and affords an admirable manual on the study of the cell in its widest aspect.

MERKENSCHLAGER, F. and KLINKOWSKI, M. 581.5
Pflanzliche Konstitutionslehre dargestellt an Kulturpflanzen. (**Plant constitution, illustrated by cultivated plants.**)
Paul Parey, Berlin, 1933 : RM. 7.50. Pp. [2] + 74. 85 illus.
By the "constitution" is understood the combination of those internal characteristics of the plant which go to make up the xerophytic species on the one hand and the hydrophytic on the other.
The general characteristics of the different types are presented by reference to the potato for the humid, coastal or mountain type, *Serradella* for the humid, mist-loving type, buckwheat for the poor soil type. In the arid group, adapted to concentrated salt solutions, white mustard illustrates the type associated with human dwellings, sugar beet the coastal type, wheat the neutral soil type, lucerne the continental type, and barley the tolerant, ubiquitous type. In addition to these two groups there exists an intermediate group comprising the yellow lupin—Mediterranean sun type—and rye—steppe type.
The discussion involves an account of the conditions most favourable to the growth of the plants in respect of such factors as humidity, light, various mineral constituents of the soil and the distribution of the species.

BRAUN-BLANQUET, J. 581.9
Plant sociology. The study of plant communities. [Translation by G. D. Fuller and H. S. Conard of "Pflanzensoziologie"]
McGraw-Hill Book Co., Inc., New York and London, 1932 : 1st ed. 27s. Pp. xviii + 439. 222 illus.
Recent studies on the geographical distribution of plant characters have introduced a new epoch into the science of plant breeding and breeders who are occupying themselves with this aspect

of the science are being brought face to face with the kindred sciences of ecology and " phyto-sociology " which are being found to have an unsuspected significance in relation to the formation and distribution of genes, characters and species.
An English edition of Dr. Braun-Blanquet's now classic work will be especially welcome therefore to such students. In this work an attempt is made to understand the causes underlying the phenomena of distribution with which recent studies have made us familiar.
The text is admirably translated and the value of the English edition has been enhanced by the inclusion of certain material not available at the time of publication of the original or for some other reason omitted. The volume is well illustrated and indexed and contains a very adequate bibliography.

SNELL, K. 633.491:581
Die Lichtkeimprüfung zur Bestimmung der Sortenechtheit von Kartoffeln. (**Determination of varietal purity of potatoes by sprouting in light.**)
Paul Parey, Berlin, 1932: RM.2.80. Pp. 40. 2 illus.

The second edition of this invaluable little work, in which the method of variety testing devised at the Biologische Reichsanstalt für Land- und Forstwirtschaft is described. The method consists in sprouting the tubers in the light, whereby each variety develops a sprout of characteristic colour and form. The colour developed in the skin of the tuber is also characteristic.
The various characters which are thus made use of and the method of testing are described, the descriptions being supplemented by a coloured plate.
According to these characters the varieties are arranged in groups, after which an alphabetical list of varieties indicates to which group each belongs. In the new edition there have been included a number of varieties which have appeared on the market since the publication of the first edition.

JANSSENS, P. E. A. 633.51(67)
Le coton en Afrique Tropicale. (**Cotton in Tropical Africa.**)
R. Bausart, Bruxelles, 1932: Belgium 60 fr., other countries 14 belgas. Pp. [3] + 402 + [4]: 99 illus.

A treatise on the cotton plant and cotton cultivation as a whole, including a description of the plant in its various stages of development, general cultural measures, pests and diseases.
A section is devoted to breeding, in which are discussed the phenomena of degeneration, mass selection, roguing, pedigree breeding and the production of pure lines, means of detecting and preventing out-pollination and determination of fibre qualities. The operations involved in these various methods are tabulated.
The book contains an account of cotton growing and cotton research in the various British, French, Italian and Portuguese colonies and protectorates in Africa and the Belgian Congo, and terminates with a selected bibliography.

HALL, A. D. and CRANE, M. B. 634.11
The apple.
Martin Hopkinson, Ltd., London, 1933: 10s. 6d. Pp. 235. 22 illus.

The volume before us is " written for the practical man, and is an attempt to put him in touch with recent developments in the practice and science of apple growing." In view of this it is surely very significant that more than half the book should be devoted to questions such as the chromosomal constitution of the apple, the various phenomena of polyploidy, variation, sports and chimaeras, and the sundry causes of sterility and incompatibility. It is indeed illustrative of the importance which the more recondite aspects of genetics are assuming not only to practical breeders, but even to the cultivator.
The authors start, after a brief historical introduction, by giving a description, couched in terms intelligible to the least technical of readers, of the chromosome mechanism of the apple. The subject of polyploidy is referred to repeatedly in the ensuing sections, in respect of its role in the formation of many well-known varieties, in governing fertility relationships and the inheritance and wide variability of characters.
A long chapter is devoted to breeding, where the laws of heredity are explained by reference to

familiar fruit-tree characters. The extreme difficulty of making desired combinations of characters, owing to polyploidy and consequent polymery, is made clear ; and the use of triploids for breeding is emphatically discouraged. Advice is given on the best method of breeding new varieties and the authors emphasize the futility of putting on the market any new variety which does not represent a real advance upon existing ones.

Advice on stocks and propagation, together with a number of more general questions of cultivation, are followed by advice as to suitable varieties, with descriptions of some of the most suitable for various purposes.

The book terminates with a selected bibliography and glossary, is well indexed and admirably illustrated.

BECKER-DILLINGEN, J. 634/5–1.8

Handbuch der Ernährung der gärtnerischen Kulturpflanzen. **(Handbook of the nutrition of horticultural plants.)**

Paul Parey, Berlin, 1933 : Bound RM 19.80. Pp. viii + 574. 119 illus.

In the present handbook the most outstanding results of the field in question during recent years are collected into the form of a general textbook.

The first three parts deal with more general questions and the fourth part, where the manuring of different cultivated plants is treated individually, will probably be of most interest to breeders and geneticists. Such points as the composition of the plant, the requirements in different manurial constituents and the time at which these are required, the symptoms of deficiency in various constituents and the form of manuring suitable are given for the various plants, some being treated more fully than others. In this way the various *Brassicas*, beets, radishes, chicories, cresses, lettuces, onions, cucurbits, tomatoes, legumes, etc., etc., among the vegetables are treated, followed by various spice and medicinal plants, ornamental plants, fruit trees and vines.

The book is furnished with excellent illustrations and index.

AN EMPIRE JOURNAL.

The new spirit of co-operation in Empire Agriculture, first exemplified by the establishment of Imperial Agricultural Bureaux and similar institutions, has expressed itself in another equally valuable form in the inauguration of the *Empire Journal of Experimental Agriculture*, the object of which is to provide research workers all over the Empire with a ready, and we hope rapid, means of publishing their results. This pooling of results at the same time affords Empire workers an opportunity of keeping in closer touch with one another's work than has hitherto been possible.

The first number, which appeared in April, 1933, contains an article on wheat breeding (see Abst. 557 above). The subscription is fixed at the moderate sum of 20s. a year.

Printed under the authority of HIS MAJESTY'S STATIONERY OFFICE
by PERCY LUND, HUMPHRIES & CO. LTD.

(862) Wt.P.1434/168/41715. 50. 11/40. P.L.H. & CO. LTD. G.943.

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